IN THE

CIRCUIT COURT

OF THE

United States

Ninth Circuit, Northern District of California

THE SPRING VALLEY WATER WORKS (a Corporation), *Complainant.* vs. THE CITY AND COUNTY OF SAN FRANCISCO (a Municipal Corporation), THE BOARD OF SUPERVISORS OF THE CITY AND COUNTY OF SAN FRANCISCO, and JAMES P. BOOTH et al., Members of and Constituting Said Board of Supervisors, *Defendants.*	No. 13,395 IN EQUITY.
THE SPRING VALLEY WATER COMPANY (a Corporation), *Complainant,* vs. THE CITY AND COUNTY OF SAN FRANCISCO (a Municipal Corporation), THE BOARD OF SUPERVISORS OF THE CITY AND COUNTY OF SAN FRANCISCO, and JAMES P. BOOTH et al., Members of and Constituting Said Board of Supervisors, *Defendants.*	Nos. 13,598 and 13,756 IN EQUITY.

VOLUME II

APPENDIX TO

Complainant's Closing Brief and Argument

Answering Defendants' Criticisms of Mr. Schussler's Testimony

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THE SPRING VALLEY WATER COMPANY (a Corporation), *Complainant,* vs. THE CITY AND COUNTY OF SAN FRANCISCO (a Municipal Corporation), THE BOARD OF SUPERVISORS OF THE CITY AND COUNTY OF SAN FRANCISCO, and JAMES P. BOOTH et al., Members of and Constituting Said Board of Supervisors, *Defendants.*	No. 13,756 IN EQUITY.

APPENDIX.

Being an Answer to the Criticisms of Defendants' Counsel on the Testimony and Estimates of Complainant's Witness, Hermann Schussler.

Counsel for defendants, in their discussion of the value of complainant's structural properties, devote over two hundred and seventy pages (pp. 199 to 475) of their brief to criticism and strictures on the testimony of Mr. Schussler. In their endeavor to weaken and break down the force of the evidence given by him, they resort to various methods and present arguments which on their face appear plausible, but which on examination can be conclusively shown to have no foundation in the testimony.

First: Throughout the whole of this part of the discussion they continually confound and confuse, or attempt to confound and confuse, Mr. Schussler's testimony and estimates as to the cost of reproducing the works if they were to be constructed at the time when he was testifying, with what they claim to be shown in some instances by testimony and in others by their own "computations" of the cost of certain materials and labor at the time the work was done.

Second: In their efforts to discredit Mr. Schussler's testimony as to the cost of wrought iron pipe used in the various pipe lines and the cost of other materials used in the works and of labor performed in construction, they cull from his testimony a few passages referring, as will be seen on examination, to only small portions of the work and not to the whole or any considerable portion. These passages they isolate from their context and from them they endeavor to make it appear that his estimates of cost of reproduction are

grossly excessive; as, for instance, in their discussion of his estimate of 10 6-10 cents per pound as the average cost of the many miles of wrought iron pipe, which is so large a factor in the complainant's system.

THIRD: They select in like manner the testimony of three or four witnesses formerly in complainant's employ, who testified as to the cost of inconsiderable portions of the work on which they were employed twenty or thirty years before the time to which the present investigation relates, and from this incomplete testimony as to the cost of small portions of work, executed in every case under exceptional circumstances, they make unwarranted deductions as to the present cost of reproduction.

FOURTH: They call attention to discrepancies between the figures presented to the Board of Supervisors in investigations conducted for rate fixing purposes in 1901 and February, 1904, and the figures sworn to on the taking of testimony in this cause, ignoring the fact that in the investigations before the Supervisors the statements made there were based on the complainant's system of bookkeeping, while the testimony shows, as has been partly pointed out in the body of this brief, that, on complainant's books "construction" was not charged as it should have been with the engineering cost and many incidentals, nor with interest during construction, and that many items that should have been charged to "construction" were charged to "operating expenses," and regardless also of the fact that in some instances, apparent discrepancies arise merely from changes made in later years in the names adopted and used by complainant in referring to some of its pipe lines and tunnels that formed portions of its system.

The methods adopted by counsel render it impracticable to follow their arguments in the order presented by them. Some preliminary explanation bearing on Mr. Schussler's testimony as a whole and elucidating the entire subject of cost of construction and the estimated cost of reproduction is necessary.

Following that general explanation, we shall discuss in detail the various specific items which defendants criticise, and show that in nearly every instance the actual cost of construction was greater than Mr. Schussler's present estimate of the cost of reproduction at the present prices of material and the present hours and wages for labor, and that Mr. Schussler's estimates, based on certain averages which he adopted, instead of being excessive, are below the probable cost of reproduction.

I.

Mr. Schussler's Testimony Was Directed Mainly, Not to What the Works Had Cost in Their Construction, but to What It Would Cost to Reproduce Them.

In their brief, the main object of defendants' counsel appears to be to show what the various portions of complainant's works have cost at the time of their original construction. For this purpose they derive much of their information from old records of complainant and from witnesses who had been employed on small parts of the older portions of the works while in course of construction. Defendants' four principal witnesses are a contractor, Mr. Emery, who executed by contract a portion of the Pilarcitos dam between 1865 and 1866 and lost a large amount of money on the job, two former employees of the complainant—Mr. Higgins,

a bricklayer, and Mr. Carey, a teamster—neither of whom has been employed by the company for a great many years since then, and Mr. Fifield, a farmer living in the neighborhood of complainant's properties in San Mateo County. Of the other witnesses called by defendants, mostly engineers by profession, none saw the entire works estimated on by them during their construction, which began about forty years before their testimony was given, the construction of complainant's works being scattered over nearly this entire period and being practically completed at the time they began to make their estimates as to the original cost of construction. These engineering witnesses of defendant (with the probable exception of the former City Engineer, Mr. Grunsky, who saw a comparatively small fraction of the later works during their course of construction) could only see the surface of the work after completion (large portions of it being underground or covered with water at the time of their inspection), and they had to be guided in part by what the four first-above mentioned witnesses testified to, and partly by professional experience with hydraulic work. The engineering witnesses gave their opinion as to the cost at which complainant's works—some of the features of which are entirely novel and original with complainant—could or should have been built for, most of them in early days when cost of materials was different from now, when price of labor, and particularly common labor, was lower, and the day's work longer than now, so that the cost of an hour's actual performance of labor was considerably less then than it is now.

On the other hand, Mr. Schussler designed and constructed most of the works during a period of nearly

forty years. His testimony throughout related to the cost of reconstructing the works of the same grade and character of materials as used and of the same design and workmanship as employed in their original construction, but under the conditions as to cost of materials and labor and hours of labor during 1903-4. Early in the taking of his testimony he was asked the following question:

> Q. 1067, page 709: "Taking now the Pilarcitos system, Mr. Schussler, I will ask you to give a general description and a detailed description of the works in connection with its construction, and what works are in use there, and your opinion and estimate based upon your opinion and your knowledge and from being an hydraulic engineer and having built the works, of their present value. Of course, I refer to the years 1903 and 1904, though there is a stipulation in the record that we may use the word 'present' with reference to the time at which the complaints were filed. So hereafter I will use the word 'present' in referring to those fiscal years. Then state also what, in your opinion and from your knowledge as an hydraulic engineer, and from the fact that you constructed these works, the cost of reproduction would be in each case?"

In his answer to that and to subsequent questions as to the Pilarcitos system and other portions of the complainant's properties, the typewritten transcript of the testimony frequently gives the word "cost" in what might appear to be the past tense, but Mr. Schussler repeatedly emphasized the fact that he was speaking in the present tense of the cost of reproduction. (See pp. 710, 724, 878, 2068, 2478, 2741.)

Counsel for complainant, however, soon noticed that confusion was liable to arise in reading the transcript

from the use of this word "cost." At page 736 he called attention to the matter, and after a colloquy between counsel for complainant and defendants and the witness, it was stipulated that the transcript "is and shall be deemed to be for all purposes in this case corrected so as to make the dollars and cents refer to the cost of reproduction at the times last stated (1903-4), and to present values, with the understanding as to the meaning of the word 'present' that we have already stipulated to."

II.

Mr. Schussler's Estimates Were Based on Known Quantities and Actual Measurements.

In preparing his estimates of what it would cost to reproduce the works of complainant under the conditions of cost of material used and cost of labor employed, if reconstructed in 1903-4, Mr. Schussler, from maps, data and diagrams on hand, and from measurements of accessible works, ascertained as near as practicable the respective dimensions of the various structures to be estimated on, thus ascertaining their weights, quantities or cubical contents. Wherever such maps, data or diagrams were incomplete or partly missing, or insufficient in detail for the purpose of the proposed estimate, such incomplete data were supplemented by careful resurveys of the respective constructed structures, so as to ascertain the cubical contents with the greatest degree of accuracy practicable under the circumstances.

While of the Crystal Springs main concrete dam, and of practically all other structures of complainant, accurate diagrams, data and maps were at hand, the principal difficulty in accurately establishing the

cubical contents (classified in the various kinds of materials and workmanship used) of the three large earth embankments of complainant in San Mateo County, viz.: the Pilarcitos, San Andres and Upper Crystal Springs dams, arose from their being partially submerged. Regarding the two latter dams, contour maps of the dam sites as they were prior to the erection of these dams, were at hand, so that a careful resurvey of the surface or dry portions of the dams, combined with a thorough system of soundings where their water slope was submerged, enabled the witness to arrive as accurately as possible at the cubical contents of these two dams.

In the case of the Pilarcitos main dam, and of some of the city reservoirs constructed before Mr. Schussler's time, where there were practically no data nor living witness at hand, in order to ascertain the cubical contents the method described in the following extract from Mr. Schussler's testimony was adopted (Test. p. 707).

> "In regard to the head works, such as Pilarcitos, San Andres and Upper Crystal Springs dams, only ideal cross and longitudinal sections were found, and they were then used in the computation of the quantities in attempts made by us heretofore to approximately ascertain the respective quantities of various classes of work needed in the construction of the dam.
>
> "When, in connection with the present suits of the Spring Valley Water Company versus the City of San Francisco, it became necessary and essential to arrive, as accurately as possible, at the cubical contents of the dams and also to proportion, as nearly as practicable, the various features in the construction and classes of work, I personally made accurate surveys, including a thorough system of soundings

of these three dams, and also caused all of the old records in our office to be thoroughly searched, with the result that we discovered some additional plans and notes relative to the foundations and sections of the dams. From these data, coupled with accurate surveys and soundings of the dams, I reconstructed the plans and we figured the cubical contents, which, although varying somewhat in the relative proportions between excavations, puddling and embankments heretofore assumed, gave the most accurate result that could be obtained under the circumstances, and, in the following estimate, I have used these results as a basis. The totals of these quantities do not differ materially from those heretofore used.

"The city reservoirs, particularly those constructed before my time, of which very few records are left, have also been resurveyed of late and computed, as nearly as practicable, as regards the respective quantities of materials moved and employed in their construction."

At page 348 of their brief counsel for defendants say:

"Mr. Schussler admitted an error of 16,000 cubic yards in his calculations of removal of top-soil and embankment work at Pilarcitos dam, and made a reduction of $20,000 in his estimate in respect to this (pp. 2025-6)." (The reference to the pages of the testimony is erroneous. The pages intended are 2035-6.)

This is not a fair statement because Mr. Schussler himself called attention to this so-called error and to others and made proper deductions for them in his estimate.

The fact is, that Mr. Schussler, after giving his direct testimony regarding the computed amount of top soil removed from the surface of the valley under

the base of the three earth dams described, in revising the figures partly computed by assistants, became convinced that the average depth of the top soil had been overestimated, and as this would affect not only the computed quantity of soil so removed, but also the quantity of bank material required to take its place, he computed the correction which it was proper to make and first notified complainant's attorney, as shown in his testimony on page 2040, which reads:

> "A. I notified Mr. Kellogg several months ago of this fact and he told me I should bring it out in court when the proper time came."

In consequence of this Mr. Schussler himself introduced this subject through complainant's attorney during his cross examination, and in relation thereto testified on page 2035:

> "I think, from my revision of this matter, that instead of assuming an average depth of topsoil removed of one and one-half yards, that about one yard in depth might be a fairer average, but it is certainly within the facts to allow for this general topsoil excavation over the whole base of these dams. This would reduce the topsoil estimate for Pilarcitos dam by about 16,000 cubic yards in round figures, which correction I wish to make in my testimony. As these 16,000 cubic yards of topsoil also represent 16,000 cubic yards of less filling of embankment, the correction of my estimate in the Pilarcitos dam is as follows:

16,000 cubic yards of topsoil removed at 40 cents per cubic yard	$ 6,400.00	
16,000 cubic yards of main-embankment, at 70 cents per cubic yard	11,200.00	
Total	$17,600.00	
Add 10 per cent for incidental and contingent expenses, engineering, superintending, etc., or	1,760.00	
We have a total of		$19,360.00
Adding to this 5 per cent for interest during construction, or		968.00
The total amounts to		$20,328.00

or, in round figures, $20,000, which, on account of the above correction, I will deduct from my total estimate of the Pilarcitos system, to-wit: $1,168,000, which leaves the corrected estimate of the Pilarcitos system, inclusive of ten per cent for incidental and contingent expenses, engineering, superintending, etc., and of 5 per cent for interest during construction, in round figures $1,148,000, instead of $1,168,-000, as given in my estimate."

Returning to the same subject at pages 2180 and 2798-2799, he voluntarily made similar deductions as to the San Andres and Upper Crystal Springs dams, and at page 2799, after explaining the corrections more fully as to the Upper Crystal Springs dam, he gives the total of all these corrections and deductions as follows:

"I have rounded them all off to the full thousand. The corrected record stands as follows:

Deduction from the total estimate of the Pilarcitos System $20,000
Deduction from the total estimate of the San Andres System 33,000
Deduction from the total estimate of the Crystal Springs System 16,000

Making a total deduction in the three systems combined .....$69,000"

The original detailed total estimates given by Mr. Schussler in his direct testimony of the cost of reproduction of these three systems are as follows:

Pilarcitos System (page 806).....$1,168,000
San Andres System (page 878)..... 1,580,000
Crystal Springs System (page 1005).... 3,827,000

Total $6,575,000

This shows that the above total sum of corrections voluntarily made by Mr. Schussler and amounting to $69,000, forms but a minute portion of the sum of the estimates of these three systems (amounting to but a fraction over one per cent). The incident, instead of casting discredit on Mr. Schussler's testimony or affecting the reliability of his estimates, as argued on behalf of defendants, only tends to show the care and conscientiousness with which his estimates were made and revised.

III.

Mr. Schussler in His Estimates Allows 10 Per Cent for Expenses of Engineering, Etc., and This Allowance Is Not Excessive.

As shown on page 647 of its testimony and also on Table No. 3 of its brief, in making its estimates of cost, for the purpose of making an allowance for "engineering, etc.," expenses, defendant adopts 7 1-2 per cent (Mr. Dockweiler's testimony). On the same table, No. 3, Mr. Grunsky, who also testified for the defendant, used 10 per cent for "incidentals."

Mr. Schussler had a great deal of practical experience in the building of the kind of structures estimated on in this case, and that experience indicated to him that his allowance of 10 per cent even is low.

When asked if the allowance of 10 per cent is usual, customary, reasonable and proper, he says (p. 725):

> "In our case it is somewhat low. In the estimates that were made by Mr. Grunsky for the proposed city sewer system, the allowance was nearly 14 per cent. Ten per cent is a reasonable, fair allowance. It is customary, from my investigation of these matters, to figure that 10 per cent will just almost cover those contingencies."

At p. 1209 he says:

> "As I have testified before, the 10 per cent that we have allowed on our works in these estimates is not quite enough, but it being necessary and having been customary in my estimates to allow 10 per cent, I have adopted the same schedule here, although in most works nowadays as high as one-seventh is added, as, for instance, in the estimates that were made for a new city sewer system, there is 14 per cent added, which is practically one-seventh of the estimated cost, because there are always unforeseen

and unknown expenses coming in, and the 10 per cent is not quite a sufficient allowance for it."

On page 2818 he testifies as follows in regard to the 10 per cent allowance for contingent and incidental expenses:

X Q. 5210. "Why should you add 10 per cent to that for contingent and incidental expenses?"

A. "There is considerable expense of that kind. We have to employ our engineering office to attend to new construction. As I stated before, the engineering department devotes its time largely to new construction and partly to the operating of the works."

X Q. 5211. "Would two-thirds of the time of the engineering department add 10 per cent to the contract price for boring those wells?"

A. "That I do not know—whether it is just the engineering department, but our general experience is that by adding to new construction 10 per cent to our works that it is a fair average. In some instances it is considerably too low. In others it may be a little too high, but as an average through the entire works we find that the 10 per cent is within the limit. The percentage frequently added, as, for instance, by the former city engineer, estimating the new sewer system, is something like 14 per cent for incidentals and contingencies, but in this case we have found that 10 per cent is a very fair rate, and I do not think, all the way through, it is quite enough."

The following quotations from Mr. Schussler's testimony explain rather more fully what he included in his 10 per cent allowances:

Page 1023. "Adding to this sum 10 per cent for incidentals, such as incidental and contingent expenses, engineering, surveying, tools, oakum, pitch, and numberless other things—sundries, we have:"

Page 1029. "Adding 10 per cent for contingent and incidental, engineering and superintending expenses, tools, light, powder, cars, track, etc."

Page 1240: "Adding 10 per cent for incidental and contingent expenses, engineering, superintending, cars, tools, track, light, air-blast, pumping, etc."

Page 1271: "Adding 10 per cent for incidental and contingent expenses, engineering superintending, inspection, tools, etc."

X Q. 2645 (page 2140): "What else besides nails?"

A. "Nails, oakum, pitch, fuel, surveying, engineering, superintending, building the roads to the flume to haul the lumber to these places and numerous things of that kind that are barely reached by 10 per cent. In fact, I have seriously contemplated to do what other people have done, to increase the ratio of percentage allowance. I think that most of this sort of work should have a greater percentage; it should be nearer one-eighth; in some instances one-seventh is added. I have been in the habit of figuring very close on my work and so I think a 10 per cent allowance for incidentals is sufficient.

"In the estimates for the city sewer system which were made by Mr. Grunsky, assisted by Mr. Rudolph Hering, the percentage of allowance for incidentals, I think, is 14 per cent, and I have seen a similar percentage quoted in other works. In this report and in this testimony I have retained the same percentage of 10 per cent because we usually figure very close."

The above quotations from Mr. Schussler's testimony show that Mr. Dockweiler's allowance of 7 1-2 per cent is altogether too low, and not warranted by experience, particularly when it is shown that defendant's estimates for its own proposed sewer system include a percentage for incidentals, etc., of nearly 14 per cent, or almost double that assumed by Mr. Dockweiler.

The reason why Mr. Grunsky adopts an allowance of nearly 14 per cent in his estimate for the proposed sewer system of defendant, where most of the problems involved are simple, not novel, and only 10 per cent, or nearly 4 per cent less, when he testifies for the same defendant in this case, in relation to complainant's works, where the work estimated on is much more complex than defendant's proposed sewer work, has never been explained.

IV.

The Reason Why Mr. Schussler Does Not Always Give the Detailed Cost of Actual Construction and the Cause of the Apparent Discrepancies Between the Figures Furnished to the Board of Supervisors and the Estimates Sworn to in the Testimony in This Cause.

A.

The So-called Failure to Show the Detailed Cost From Complainant's Books.

Counsel for defendants, at page 458 of their brief, contend that Mr. Schussler ought to have shown from the books and records of the company the detailed cost of the various structures as to which he was testifying, and they endeavor to draw inferences unfavorable to his testimony from the fact that he did not do so.

Mr. Schussler repeatedly, while under cross-examination by defendants' counsel, explained why in testifying in this case he did not resort to the bookkeeping accounts kept by the complainant. He showed that these accounts were kept by the Accounting Department of the complainant which was entirely separate from the Engineer's Department, which was the only department of which he had charge; that many accounts chargeable to construction were charged in the secre-

tary's or accountant's books in lump sums and were not apportioned to the separate structures; that in some cases expenditures of large amounts that in Mr. Schussler's opinion were chargeable to one structure, had been charged by the accountant to another account; that the proportion chargeable for engineering, surveying, superintending, legal and office expenses was not apportioned on the books to any particular structure, but that salaries were charged by the year or by the month to a special salary account; that the secretary did not keep an account of interest lost during the progress of construction, and that interest paid by the complainant during the construction of any special structure was charged in a lump sum to the general interest account and not specially apportioned and segregated to separate new construction accounts.

Furthermore, the object of Mr. Schussler's testimony in this investigation was not to show what the works had cost in time past, but what it would cost to reproduce them at the time to which the investigation related. These facts are abundantly shown from his testimony.

(See testimony page 2207, cross questions 2900-2903; pages 2479-2480, cross questions 3901-3914; page 2485, cross question 3921; page 2763, cross questions 4964-4969; page 2179, cross question 2796; page 2603, cross question 4417; page 2606, cross questions 4425-4436; page 1803, cross question 1122.)

Examination of the pages referred to will show conclusively the lack of justification for this portion of defendants' comments on Mr. Schussler's evidence. The testimony also shows that in some instances expenditures which in Mr. Schussler's opinion were chargeable to one structure or portion of a structure, had

been charged on the books to another, notably in the case of the Upper and Lower Crystal Springs dams, where large amounts had been charged against one dam which in Mr. Schussler's opinion were properly chargeable to the other.

B.

THE SO-CALLED DISCREPANCIES BETWEEN MR. SCHUSSLER'S ESTIMATES BEFORE THE BOARD OF SUPERVISORS AND HIS TESTIMONY IN THIS CASE.

At page 452 of their brief, counsel for defendants, commenting on what they term the unreliability of Mr. Schussler's estimates, direct attention to differences between estimates made by him before the Board of Supervisors in 1901 and in February, 1904, and his testimony in this suit in August and following months of the latter year. At pages 453-4 of their brief they insert a table, designated by them as "Table 36," containing twenty items picked out by themselves from Mr. Schussler's testimony as to only some of the structures, in which they make a comparison of his estimates in this suit with those made in the previous investigations before the Board of Supervisors.

THAT TABLE AFFORDS NO PROPER BASIS OF COMPARISON.

FIRST: The figures given in the column headed "Estimates of 1901" were not in fact Mr. Schussler's estimates. As previously explained and as repeatedly iterated and reiterated by Mr. Schussler in his answers referred to by page and number in the preceding subdivision hereof, those so-called "Estimates of 1901" were figures furnished by the secretary from his books showing what had been charged on the books to the cost of construction, omitting large amounts which, as Mr. Schussler shows and as we have shown in the main body of this brief, should have been charged to that account.

SECOND: Even if the secretary's figures for 1901 had included everything properly chargeable to the cost of construction, which they did not, the table would have afforded no basis for comparison with Mr. Schussler's figures in this suit, which are based on careful measurements and calculations of dimensions, quantities and qualities, and are given as estimates of what it would cost to reproduce the structures with the same quality of materials and workmanship used in their original construction, but constructed under the conditions as to cost of materials and labor and hours of labor prevailing in the years 1903-4.

THIRD: The testimony shows that as to some of the items, although the particular structure selected for comparison is designated in the various estimates by the same name, the later estimate refers to a different structure. The attention of counsel for defendants was called directly to this fact by the testimony, so that it is difficult to find justification for their attempt to use in argument comparisons, which in such instances, are unfair upon their face.

Take, for instance, the item designated "Ocean House Flume" in which counsel draw comparisons between the estimate of $9000 in 1901 and $12,000 in February, 1904, and $15,750 in Mr. Schussler's testimony. Counsel for defendants must have been aware that these estimates did not refer to the same structure. The estimates of 1901 and February, 1904, referred to an old flume built about thirty years ago. That flume was completely rebuilt and enlarged to about double its former capacity in the first half of the year 1904 (see Mr. Schussler's testimony, p. 2472 X. Q. 3864, and p. 2504 X. Q. 4010.) And in his direct testimony (p. 787) he shows that he had then with him an account show-

ing the exact cost of the materials and labor used in 4130 feet of the flume, the total length of which when completed was 5250 feet, and these items alone for just about three-fourths of the work amounted to $11,226. From this Mr. Schussler obtained an average cost of 14 1-10 a foot board measure for the 101,480 feet of A. No. 1 clear surfaced redwood lumber used in the whole work, or a total cost for material and labor of $14,309, which with ten per cent added for incidentals and cost of engineering, superintending, etc., brought his total estimate up to $15,750.

On cross-examination by Mr. Partridge, Mr. Schussler testified as follows:

X Q. 1091. "May I ask why that has just been built?"

A. "It had to be rebuilt for two reasons. One reason was it had been built 30 years ago; it could have been kept going for 5 or 10 years yet, but we needed to get more water through it, so we rebuilt it and we more than doubled its capacity. That gave us a splendid chance to tally exactly what this cost. I was particular to find out what the difference was in the construction of similar work in one locality and in another. I used those figures for making estimates and those formed a very good basis for estimates of similar work, as is shown by the difference of nearly 4 cents a foot, board measure, in favor of this location where hauling and transportation were much less and where the grading was extremely light."

This experience with the Ocean House Flume is valuable for another reason. This work having been done in the year 1904 under the then existing conditions as to cost of material and labor, afforded reliable infor-

mation and data for the purpose of verifying estimates of other work of similar character.

Again, in the same Table 36 counsel for defendants make comparisons between the figures furnished to the Board of Supervisors for the "Crystal Springs Pumping" station of $91,610.48 in 1901 and Mr. Schussler's estimate in this suit of $165,300. The testimony shows that the former figures were taken from the secretary's report, which, in that item, dealt only with the cost of the pump, while Mr. Schussler's estimates included the entire aqueduct from the station to the Locks Creek line, besides a large amount of additional construction. As to this item we quote from Mr. Schussler's testimony as follows: (p. 2243).

X Q. 3013. "While you are having those figures looked up I will ask you another question. In your exhibit filed with the Board of Supervisors ——"

A. (Interrupting) "My exhibit or the secretary's"

X Q. 3014. "The secretary's; the exhibit of cost filed in 1901 in the water rate investigation for 1901-02, was not the cost of that pumping plant at $91,610.49?"

A. "It is very possible the secretary put it in at that figure."

X Q. 3015. "If the secretary put it that way it would be the correct amount of the actual cost for the pumping station, would it not?"

A. "That I cannot tell. If he has taken in everything in his account I do not know, but I know this; that we borrowed from the city pipe system the force pipes laid up the hill."

X Q. 3016. "And that is at $8000?"

A. "No, sir; there was a long treble line of force pipe which I have described in detail in my estimate."

X Q. 3017. "If that was so, if it were not included, would that make that difference of $74,000 between that amount and your estimate of $165,300?"

A. "As I have stated before, my estimate states what it would cost during the year 1903-04 to reproduce this pumping plant, and this estimate of mine includes a great many things that Mr. Ames has not in his charges."

X Q. 3018. "What are they?"

A. "Mr. Ames has charged no doubt simply the Crystal Springs pumping plant to this account, but I have included the entire aqueduct from there to the Locks Creek line also, and also, since that time, this additional construction of about $8000. I have furnished you in detail my estimate of the Crystal Springs pumping plant, specifying in detail all the things I have charged to it, and Mr. Ames evidently has not got that in. He is the only man to explain his own figures."

X Q. 3019. "How do you know that you have?"

A. "I know exactly what I added to my estimate."

X Q. 3020. "Do you know exactly what he had?"

A. "No, sir, I have no idea."

X Q. 3021. "Then how can you say that?"

A. "I say I think so."

X Q. 3022. "Oh, you think so."

A. "Yes, for instance, the flumes—6,300 feet of flume, 48 by 26 inches; 10,500 feet of flume, 60 by 30 inch, $50,358. I am quite well satisfied that he has not charged that to the pumps. You can find that out from him. We have three lines of 16 inch discharge pipe which lead up the hill to the flume box over the hill, $19,425. I do not know whether Mr. Ames has charged that to his Crystal Springs pump

account because that is city pipe. He took that pipe out of our city pipe yard. Then this item of $8000 more or less, for this connection around the regulating gate, which I have just quoted, which gives you already a sum total, in round figures, of fully $50,000 for the flume, fully $19,000 for the force pipe, and $8000 for the next connections made in 1902, or a total of $77,000. It is very questionable in my mind whether Mr. Ames had those data in his estimate. He may have partly, but I do not think so. He has simply, in my estimation, charged to the Crystal Springs pump account the new expenditures that we made on account of that pump, but you can very easily find that out from him. My estimates are made entirely independent of Mr. Ames' book account, and consequently I am not answerable for his extracts from his books given to the supervisors from time to time."

By referring to the Municipal Report of 1900-01, page 48 of appendix, it will be seen that the secretary's exhibit gives the following: "4. Pump built in 1898 —$91,610.49," while Mr. Schussler's testimony on this subject, as given on page 1302 of his testimony, distinctly heads the items which he includes in his estimate: "Crystal Springs Pumping Station" and then proceeds to enumerate the pumps and various other separate items estimated on by him. The Secretary's item in the Municipal Report of 1900-01 distinctly marked, "4. Pump built in 1898—$91,610.49," no doubt simply refers to the pumping machinery within the engine house, while Mr. Schussler distinctly heads his estimate, on page 1302 of his testimony by the words "Crystal Springs Pumping Station," in which his testimony shows that he also includes all pipes, connections, flumes, etc., outside of the engine house, as enumerated thereafter; showing that the two fig-

ures given by the secretary to the supervisors on the one hand, and by Mr. Schussler in his testimony on the other, are for two entirely different things, the former being a portion of the latter.

It is of interest to note here that, in Table 3, opposite to page 198 of defendants' brief, defendants' own witness, Mr. Grunsky, although not conversant with the detail work on this plant during its construction, makes a lump estimate for this plant for the Board of Public Works, on January 30th, 1903, of $125,756, while in his report to the same board, dated January 26th, 1904, his lump estimate for the same plant is $130,756, or about $39,000 more than the figures furnished by the secretary. And though Mr. Grunsky's estimate is lower than Mr. Schussler's, it is only an estimate in the lump, while Mr. Schussler's, which includes 10% for engineering, incidentals, etc., gives every detail of the entire plant, so that each separate item is subject to verification.

Take again the item "Pilarcitos Side Flume" which in the estimates of 1901 and February, 1904 are given respectively as $10,000 and $18,000 and are estimated by Mr. Schussler in this suit at $20,000. Those differences are fully explained in Mr. Schussler's testimony (p. 2301, XQ. 3090, and page 2472 X QQ. 3856, 3857). It appears from the testimony that the item $10,000 was rounded off from $9770.04 which was the charge for cost as carried on the secretary's books of an old flume built in 1864. As shown in Mr. Schussler's answer to cross question 3857, his estimate in this suit included the present "main flume and its branch flume." It may be noted here that Mr. Grunsky estimated this same flume in 1901 at $14,000 plus ten per cent for engineering and expenses, or a total of $15,-

400 (See Municipal Reports 1900-01, Appendix p. 213). Mr. Schussler in his answer to cross question 3120, shows [illegible] between February, 1902 and July 1st, 1903, wages, [illegible]r of the character employed in this work had increased fifty per cent.

FOURTH. As to the differences between the estimates furnished by Mr. Schussler to the board of supervisors in February, 1904, and his estimates in this suit in the fall of the same year, the reason for the differences is fully explained in his testimony. His testimony in this suit was given, as we have seen, after careful surveys and measurements and elaborate investigation of every detail necessary to arrive at an accurate conclusion as to every item; his estimates in February, 1904, were, as he repeatedly testified, approximations only, hurriedly prepared on a notice of only five days. (See Testimony p. 2499; X QQ. 3979-3991; p. 2514, X QQ. 4055, 4056.)

V.

DEFENDANTS' TABLE 35 (BRIEF PAGE 450) PURPORTING TO BE A COMPARISON BETWEEN MR. SCHUSSLER'S ESTIMATES AND THE ACTUAL COST OF CONSTRUCTION, IS MISLEADING. THE FIGURES GIVEN IN THE TABLE ARE AS TO MANY MOST IMPORTANT MATTERS NOT TAKEN FROM THE TESTIMONY, BUT ARE "COMPUTATIONS" MADE BY DEFENDANTS' COUNSEL, AND THESE COMPUTATIONS ARE NOT WARRANTED BY THE TESTIMONY ON WHICH THEY PURPORT TO BE BASED.

Defendants' Table 35 (brief p. 450) is entitled: "Discrepancies between Mr. Schussler's estimates of present value of the structural properties of complainant and cost prices obtained from the account books,

minutes, contracts, and testimony of contractors, detailed in the discussion thereon in a prior section of this brief."

In introducing this table they say, in effect, there, in argument (pp. 447-449) that "the evidence warrants the conclusion that the cost of reduplication of these properties in 1903-04 would not have been much, if any, in excess of the cost of original construction" (p. 448); that this table does in effect show the cost of original construction; that Mr. Schussler's estimates of present value are 44 per cent higher than the original cost; and this excess of Mr. Schussler's estimates over their computation of the original cost furnishes a reason why Mr. Schussler's estimates should be disregarded as unreliable. To save the court the time and labor of turning to defendants' brief for this Table 35 to verify what will be said in the ensuing discussion, we reproduce it here.

DEFENDANTS' TABLE NO. 35

DISCREPANCIES BETWEEN MR. SCHUSSLER'S ESTIMATES OF PRESENT VALUE OF THE STRUCTURAL PROPERTIES OF COMPLAINANT AND COST PRICES OBTAINED FROM THE ACCOUNT BOOKS, MINUTES, CONTRACTS AND TESTIMONY OF CONTRACTORS, DETAILED IN THE DISCUSSION THEREON IN A PRIOR SECTION OF THIS BRIEF

Structure or Portion of Structure	Mr. Schussler		COST			
	Estimates on Structures or portions of Structures	Page or table in this (Defendants') brief	Amount	Source of information	Page or table in this (Defendants') brief	Difference between Mr. Schussler's estimate and cost price
Alameda 36-inch pipe-line (plate iron, laying of pipe)	$ †728,747.00	Table No. 7	$ 428,480.00	Computation	Table No. 7	$ 300,267.00
Crystal Springs pipe-line (plate iron)	†463,673.00	Table No. 7	302,941.00	Computation	Table No. 7	160,732.00
Pilarcitos pipe-line (plate-iron)	†151,271.00	Table No. 7	84,714.00	Computation	Table No. 7	66,557.00
San Andreas pipe-line (plate-iron, making and laying of pipe)	†422,641.00	Table No. 7	261,190.00	Computation	Table No. 7	161,451.00
22-inch submarine pipe (making and laying)	182,380.00	(p. 263)	148,240.00	Pipe contract	(p. 263)	34,140.00
Sunol filter galleries, dam and aqueduct	872,000.00	Table No. 3	714,541.37	Mr. Reynolds	(p. 291)	157,458.63
Pleasanton improvements	99,700.00	Table No. 3	82,443.05	Mr. Reynolds	(pp. 294–5)	17,256.95
Six-mile tunnel	49,800.00	Table No. 16	23,928.95	Mr. Higgins	Table No. 16	25,871.05
South Lake Merced drainage system	264,300.00	(p. 321)	176,914.00	Mr. Schussler	(p. 321)	87,386.00
Pilarcitos dam, waste-weir and gate-house	441,400.00	Table No. 3	335,749.36	Mr. Wenzelburger	(pp. 343–4)	105,650.64
Pilarcitos upper dam	39,000.00	Table No. 3	31,376.40	Mr. Wenzelburger	(p. 361)	7,623.60
Pilarcitos side flume	20,000.00	Table No. 3	13,525.88	Mr. Wenzelburger	(p. 366)	6,474.12
Pilarcitos Tunnel No. 1, brick-work	23,631.00	Table No. 21	12,220.00	Mr. Higgins	Table No. 21	11,411.00
Lake Honda tunnel and tanks	70,560.00	(p. 384)	52,372.12	Mr. Wenzelburger	(p. 384)	18,187.88
San Andreas dam, waste-weir and forebays	682,500.00	(p. 385)	461,460.46	Mr. Wenzelburger	(p. 386)	221,039.54
Bald Hill tunnel, brickwork	36,603.00	Table No. 26	17,469.00	Mr. Higgins	Table No. 26	19,134.00
Bald Hill tunnel, drifting	27,918.00	(p. 399)	23,970.00	Minutes	(p. 399)	3,948.00
Davis tunnel *	41,500.00	Table No. 3	32,287.08	Messers. Reynolds and Wenzelburger	(p. 402)	9,212.92
Locks Creek tunnel No. 1, brick-work	51,110.00	Table No. 28	30,272.00	Mr. Higgins	Table No. 28	20,838.00
University Mound reservoir, concrete lining	59,400.00	(p. 421)	39,600.00	Mr. Higgins	(p. 421)	19,800.00
College Hill reservoir, rock excavation	17,985.00	(p. 422)	10,627.50	Minutes	(p. 422)	7,357.50
Clarendon Heights tank, excation and tank	10,494.00	(p. 423)	6,662.83	Minutes	(p. 423)	3,831.17
Pumping plants **	1,620,000.00	Table No. 31	1,135,644.62	Messrs. Reynolds and Wenzelburger	Table No. 31	484,355.38
	$6,376,613.00		$4,426,629.62			$1,949,983.38

*Should read $40,200.00.
**Should read $1,541,350.00.
†Not taken from MR. SCHUSSLER'S estimates.

These footnotes and the star references thereto are our own—*Complainant's Counsel.*

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In this table the column of figures under the general heading "Mr. Schussler," purports to give his estimates of cost of reproduction of the twenty-three structures named in the first column of the table. As to the first four large items, namely: "Alameda 36-inch Pipe Line," "Crystal Springs Pipe Line," "Pilarcitos Pipe Line" and "San Andreas Pipe Line," aggregating over $1,760,000, the figures were not taken from Mr. Schussler's testimony of estimated cost of reproduction under the conditions existing in 1903-04. While they are included under the general head "Mr. Schussler" so as to make it appear that they were taken from his testimony, they were arrived at by defendants' counsel by a method of "computation" which will be analyzed later, in which analysis it will be shown that Mr. Schussler's testimony does not give any such data. The figures in the same column for the other nineteen items are taken from Mr. Schussler's testimony except that the following corrections should be noted, viz: The figure for the eighteenth item "Davis Tunnel" in the same column, should read $40,200 instead of $41,500. The twenty-third item "Pumping Plants" should read $1,541,350 and it should be noted that this amount includes $78,-650 for interest during construction, while interest during construction is *not* included in any of the other eighteen items taken from Mr. Schussler's testimony. By making these two corrections, the nineteen figures taken from Mr. Schussler's testimony commencing with the fifth item "22-inch Submarine Pipe" and reading down to the end of the column, *all* contain ten per cent allowance for incidentals, engineering, etc., but will contain *no* allowance for interest during construction.

The heading "Page or Table in this brief" at the top of the adjoining column, indicates that a further selection of figures has been made by defendants' counsel from a number of tables prepared by them and from several pages of their brief, in order to show by such figures the discrepancies which they claim to exist between Mr. Schussler's testimony regarding cost of reproduction in 1903-04 and what they assert to be the "cost" of these "structures or portions of structures" basing their assertions on their own "computations" and on what they claim to have shown by various witnesses; but by grouping this column and the estimated figures under the one heading "Mr. Schussler" they endeavor to make it appear that Mr. Schussler is responsible for *all* of the figures given and also for its various tables and the facts stated in the pages of their brief to which reference is made.

We desire, therefore, to emphasize again the fact that Mr. Schussler is not responsible for the showing made in defendants' Table No. 35, as might be inferred therefrom and from the accompanying comments in defendants' brief, but only for such estimates and figures as were testified to by him in great detail—his testimony *regarding each group of such details being complete for each structure and system,* as will be shown further on, when, in this brief, the discussion of the respective items is reached.

As heretofore stated and explained, Mr. Schussler's complete estimates of value are entirely based upon what it would cost to reproduce the constructed works of complainant under the conditions of cost of materials and labor ruling in 1903-04, while in the four columns grouped under the general heading "Cost" in this Table No. 35, defendants' counsel attempt to es-

tablish the present value of these structures or portions of structures by what expert accountants claim to have been able to gather from complainant's books and accounts and from the testimony of various witnesses. The books and accounts as heretofore shown, do not charge to construction everything properly chargeable thereto, and in a number of instances the information gathered from them is misleading by reason of changes in the nomenclature of some of the structures or changes in the grouping of various portions of the structures as parts of different systems. The witnesses whose testimony is the basis of their various "computations" are persons who for many years have not been employed by or connected with complainant, and even when employed were so employed in connection with only comparatively small fractions of the works.

Reference is here made to what has been heretofore said in the body of this brief and in this appendix as to the system of entries in the books of complainant's secretary in former years, showing many omissions of proper charges and the misplacing or misnaming of others. It is fair to assume that if it were practicable to have all the old construction accounts examined in detail by one who was not only an expert accountant but also a witness of and during the construction of all of the respective works built in the past and thoroughly familiar with the various methods of their construction and their separate and detailed costs, that would be the surest method by which the original cost of a separate "structure or portion of structure" could be arrived at.

To the figures thus obtained there would have to be added the proper percentage for engineering and

contingent expenses, as well as interest during construction, as a large portion of *the former* (particularly the engineering, etc., expenses) were formerly not charged to new construction, but instead were charged to salary account, and the *latter* (the interest during construction) was not separately charged to each structure nor even to each of complainant's separate systems, but was instead charged to the general interest account only.

In their statement preceding the introduction of this Table 35, counsel for defendants admit and state that the structures shown on the table were only *"approximately one-third of* the total value of the structural properties of complainant." On page 449 they say: "It is fair to assume" that the same proportion of excess estimate over what they claim is shown by the table to be the original cost "would be shown if the cost of the balance of the structural properties could be obtained" and that for this reason Mr. Schussler's estimates should be disregarded as unreliable. From the analysis of the table which will follow, it will be seen, that in taking what they admit is only one-third of the structural properties, counsel seem to have selected certain specific items apparently best suited to the purpose of making the so-called discrepancies appear as large as possible between what they call *original cost* and what Mr. Schussler showed *in detail* would be the cost of reproduction. From this fact and from what we have said and will more fully show hereafter regarding the sources and character of most of the information and testimony on which defendants rely and the methods adopted by counsel in their use of the same, it will be seen that the table is valueless for any purpose of comparison, especially in view of the

fact that Mr. Schussler does not attempt even approximately to establish the *original* cost, either in the peculiar complicated manner adopted by defendants' counsel or in any other manner.

Even if complainant's books had been at all times kept so as to show in exact detail the cost of each structure with the quantities and qualities and separate costs of the various materials used and of the great variety of skilled and common labor employed in each separate portion of each structure, and if to each of these items of cost had been added the proper proportion of engineering and other contingent expenses, as well as the properly proportioned interest (which during earlier days was much higher than now) expended during construction,—*even then,* if such original cost could be and had been accurately established —while the data so gathered relating to quantities and qualities of materials used and the segregated number of hours' labor of each specific class therein employed would be of great value in order to establish, under the present condition of cost of materials and labor, what the works would cost to reproduce them in 1903-04, the original cost so established would in no manner represent the present value.

If, for example, the works of complainant had been built at a time in the past when the cost of materials and labor was higher than in 1903-04, and the works, if they were to be built now, could be constructed for much less than what they cost originally, it would not be fair for complainant to claim that the present value of the works would be equal to their original, but in that case, much higher cost.

If, on the other hand, as complainant has shown by Mr. Schussler's testimony, some of the materials are

higher and all of the labor employed is much higher in 1903-04 than at the time of the original construction of far the larger portion of complainant's principal works, it is equally unfair to judge the present value of the works by what they have cost in the past under entirely different conditions, even if such original cost could now be established and verified.

General Analysis of Defendants' Table 35.

From what has been heretofore shown as to defendants' manner of selecting certain items for comparison, by means of a combination of either wholly or partly quoted testimony, with defendants' own computations, and from what will be hereafter detailed in this brief, we will show that the statement on page 448 of defendants' brief that defendant's figures given in its Table 35 "present clearly the discrepancies between Mr. Schussler's estimates on structures (or portions thereof) and the actual cost," is not true and does not conform with the facts nor with Mr. Schussler's testimony; and furthermore, defendants have by no means proven that what they call the *actual cost,* actually is the cost.

We will in like manner show that the statement on page 448 of defendants' brief that "the evidence warrants the conclusion that the cost of reduplication of these properties in 1903-04 would not have been much, if any, in excess of the cost of original construction," is an entirely unwarranted statement and does not conform with the facts shown as to the differences between the conditions existing during the bulk of the period when defendants' works were being constructed and those prevailing in the year 1903-04—for which latter period Mr. Schussler's careful and detailed estimates were made—it being not only a well known

fact but also fully shown in Mr. Schussler's testimony, that as one element of cost alone the cost of an hour's labor had increased fully fifty per cent between the two periods.

In the same manner we will show that the statement in the concluding sentence of the paragraph on pages 448 and 449 of defendants' brief that "Mr. Schussler's estimates of present value are forty-four (44%) per cent higher than the original cost of these structures," is not warranted by the *facts,* nor by the method employed by defendants in order to get at what they claim to be "the original cost of these structures."

By closely examining defendants' Table 35 it will be found that defendants' counsel, amongst other things, have carefully picked out only such fractional portions of each of four of complainant's structures, which apparently best suited their method of trying to arrive by "computation" at what they call the cost of these selected fractional portions of these four structures. It will be noted, furthermore, that they carefully avoid stating in connection with these four *computed* items how the *"actual original cost"* (at the time when these works were built) of *the remaining portion* of each of these structures (which very important portions defendants for some reason fail to mention) compares with Mr. Schussler's careful and detailed estimate of the cost of reconstructing in 1903-04 the four *entire* and *complete* respective structures to which he testified.

It is probable that if they had done this they would have found that, even if compared with defendants' so *"computed"* figures of original cost, the percentage of difference between the latter figures and Mr. Schuss-

ler's testimony regarding these structures *complete* would have been considerably less than the forty-four per cent assumed by defendants; and furthermore, defendants, or their counsel, would *not* have invited the suspicion that these items were so selected and computed as to produce as great an apparent difference between their own "*computed*" figures of cost of certain "portions" of complainant's structures and the "corresponding portions" of complainant's estimates similarly "computed" by them.

The remaining nineteen items of Table 35 selected by defendants for their comparative percentage table, have, as appears on the face of this table and as will be more fully shown hereafter, a variety of sources of a greater or less degree of reliability.

The various methods by which defendants' counsel arrive at what they call the "cost of structures and portions of structures" are shown in defendants' brief. By those methods they arrive, in Table 35, at a final total, estimated or "computed" cost of twenty-three selected structures and *portions* of structures, of $4,426,629.62. These figures, it is evident—judging from the sources from which they came and the methods employed in collecting and computing them—do not include any ten per cent allowance for engineering and contingent expenses nor five per cent allowance (which is shown to be the least amount proper) for interest during construction. If this allowance has not been made by defendants, then in order to arrive at a much fairer degree of comparison than presented by Table 35 (even if for argument's sake we omit, for the present, any consideration of the generally unreliable character of the "cost" figures given in the table) it would be necessary, to begin with, to add ten

per cent to the above total of defendants' "cost" figure of $4,426,629.62, which would change this total of defendants' "cost" estimate to $4,869,292.00.

In order to make the proper comparison between the latter total and the corresponding total of what the table gives as Mr. Schussler's estimates of the same twenty-three estimates, allowance must be made for the fact that while all of the latter include ten per cent for contingent and engineering, etc., expense, only one of the twenty-three items: "Pumping Plants —$1,620,000.00," includes also five per cent for interest during construction. It will be necessary, therefore, to deduct from the total of defendants' "cost" estimates of $6,376,613.00 the sum of $78,650.00 which was included for interest in the *total* pump estimate of $1,620,000.00, as shown in defendants' Table No. 31. This deduction leaves a balance of $6,297,963.00.

That would be the *total* of the Schussler reduplication estimate in defendants' Table No. 35, *after* having been modified, as above stated, so as to properly compare with the total of defendants' cost column in the same table, which, after it also has been modified, so as to contain ten per cent for contingent and engineering, etc., expenses, will be as above shown $4,869,292.00. By dividing the results so obtained we have $6,297,963.00, divided by $4,869,292.00, giving 1.2934.

In other words, the total, so modified, of defendants' "computed" Schussler estimates of reduplication of the twenty-three selected structures and portions of structures, is 29.34 per cent greater than the total of defendants' "computed" cost of the same items, instead of forty-four per cent as stated on page 449 of defendants' brief.

By again referring to defendants' Table 35 it will be found that the four so-called "computed" items which head its list of the so-called Schussler estimates, represent a total sum of $1,766,332.00, while the sum of the corresponding four items of defendants' computed "cost" column is $1,077,325.00. By dividing the former by the latter figure we have as a result that the former exceeds the latter by 63.95 per cent.

By adding together the remaining nineteen items from defendants' Table 35, which, as defendants state in this table, have been obtained from a variety of sources, we have for the so-called Schussler column a total of $4,610,281.00, and for the defendants' computed "cost" column a total of $3,349,304.00.

By dividing the former by the latter figure we have as a result that the former exceeds the latter by 37.65 per cent.

The paragraph on page 449 of defendants' brief which states that "Mr. Schussler's estimates of present value are forty-four (44%) per cent higher than the original cost of these structures," which forty-four per cent would represent the average of the twenty-three items, does not call attention to the fact that the nineteen items, the figures for which they have collected by various methods and from a variety of sources, differ only 37.65 per cent, while the four items which head the list, after going through a combined process of selection of fractional portions of structures and making "computations" on them, give a difference between the two columns of 63.95 per cent.

A recapitulation of the *percentage of differences* hereinabove deduced from defendants' Table No. 35, existing between what counsel calls "cost" and what they call "Mr. Schussler's Estimates" shows the fol-

lowing results, all of them indicating that their "computed" cost figures are *below* what they assert to be Mr. Schussler's estimates. At the same time, this recapitulation will show the difference in per cent of the two groups of which defendants' figures are composed, viz: the *computed* and the *uncomputed* group, and also what the percentage result of difference between their "Schussler Estimate" column and their "cost" column appears to be and what it would be if both had been brought to the same basis (as they should have been for a fairer comparison) by the proper allowance for contingent, engineering, etc., expenses in *both* of these columns of defendants' Table No. 35:

RECAPITULATION.

a. The total of defendant's entire Schussler column exceeds that of its entire cost column by 44%

b. The total of the first four figures *computed* by defendant in the Schussler column exceeds the total of the four corresponding computed figures in the cost column by.. 63.95%

c. The total of the remaining nineteen *uncomputed* figures in the Schussler column exceeds the total of the corresponding *uncomputed* nineteen figures in the cost column by 37.65%

d. The total of the entire Schussler column of defendants' table No. 35 (if modified regarding correction of errors as above shown) exceeds the total of the entire so-called cost column in the same table, after being modified (regarding allowance for contingent and engineering, etc., expenses, as above shown) by..... 29.34%

In other words, a comparison between the above results (a, b, c and d) shows that defendants' claim of

forty-four (44) per cent excess (*a*) when compared with what it would be if modified as above shown, of 29.34% (*d*), shows an excess of the former over the *latter* figure of 49.96%, or practically, 50%; while the excess percentage of defendants' four *"computed"* figures of 63.95% (*b*), when compared with the excess percentage of its remaining nineteen *"uncomputed"* figures of 37.65% (*c*), shows an excess of the former over the latter figure of 69.85% or, practically, 70%.

Further comment on this subject is unnecessary. It is quite apparent from the general analysis we have made that the object of defendants' table No. 35 was to show as large a discrepancy as possible between what it calls *"Mr. Schussler's estimates"* and defendant's so-called *"cost amounts."*

THE COST OF CONSTRUCTION AS SHOWN BY THE ACCOUNTS COMPARED WITH DEFENDANTS' COMPUTED COST.

In order to assist in determining as near as practicable, under the circumstances, the original cost of construction, or at least the amounts charged to such construction accounts, of such of complainant's works as were constructed between June 1st, 1865, and December 31st, 1904, and also in order to assist in the analysis of defendants' assumed figures of cost of construction of complainant's works,—complainant furnishes the following three tables which are numbered respectively I, II and III.

The items and figures contained in these three tables are taken from the testimony of Mr. Reynolds, who was complainant's witness regarding the latter's accounts.

Table I, which is divided into two groups,—one comprising the period from June 1st, 1865, to June 30th, 1882, includes what may be called the original or

older works constructed by complainant during this period. The other group of charges, comprising the period from July 1st, 1882, to December 31st, 1904, includes the more recent works, which were constructed by complainant during the latter period.

Table I gives the page number of Mr. Reynolds' testimony from which the respective figures are quoted; the years during which the charges were made in complainant's account books; the amounts charged to and credited to construction; and also the net annual charges to construction.

All of the above figures, given in Table I, relate to construction of works and to acquisition of properties and rights during the respective years.

Table I furthermore shows separately the totals of charges, as detailed in Tables II and III, for constructed works for the respective periods from 1866 to 1882, and from 1883 to 1904.

Only such structures are enumerated in Tables II and III as were constructed during the periods shown on the respective tables, and which structures are estimated on in Mr. Schussler's testimony, based upon their existing dimensions and cost of reproduction in 1903-04.

Table II, being an extract from Mr. Reynolds' testimony, gives the amounts charged by complainant to the specific structures erected by the latter during the period from June 1st, 1865, to June 30th, 1882. During this period, besides a considerable extension to the city distributing system, there were constructed by complainant other large and costly works, which either have not been mentioned at all in the above-quoted testimony of Mr. Reynolds *under their proper name,* or have only been mentioned by a fractional portion of their cost, and as it is probable (such charges not

having been specifically made under their proper name) that they may have been charged under the head of *"new construction," "general expense," "general construction," "*contingent expenses"* or *"salaries"* and *"instruments,"*—these six latter charges for each year in which they occur have been placed at the head of the various charges for construction, contained in Table II.

TABLE I

AMOUNTS CHARGED AND CREDITED TO CONSTRUCTION ACCOUNT

From Mr. Reynolds' Testimony, Pages 5345 to 5688

Page	Year Ending	Amount Charged Annually	Total Amount Charged	Amount Credited Annually	Total Amount Credited	Net Annual Charges to Construction Account	Total Net Charges to Construction Account	Total of Charges for Constructed Works as Detailed in Table II, During First period, From 1866 to 1882, Both Inclusive	Total of Charges for Constructed Works as Detailed in Table III During Second Period, From 1883 to 1904, Both Inclusive	Total of all Charges for Constructed Works as Detailed in Tables II and III From June 1, 1865, to December 31, 1904
5345	June 1, 1866*	$ 197,924.25		$ 90,351.44		$ 107,572.81				
5346	" " 1867	296,785.55		Two credits amount not given		296,785.55				
5347	" " 1868	757,318.24		No Credits		757,318.24				
5348	" " 1869	639,798.09		" "		639,798.09				
5350	" " 1870	472,883.07		" "		472,883.07				
5350	" " 1871	798,461.44		No Offsets		798,461.44				
5351	" " 1872	547,575.97		No Credits		547,575.97				
5353	" " 1873	179,060.58		" "		179,060.58				
5355	" " 1874	176,390.09		No Offsets		176,390.09				
5356	" " 1875	316,514.74		33,078.76		283,435.98				
5358	" " 1876	856,480.15		No Credits		856,480.15				
5359	" " 1877	661,159.86		1,015,469.68		—354,309.82				
5360	" " 1878	787,065.52		No Credits		787,065.52				
5361	" " 1879	8,470.23		" "		8,470.23				
5668	" 30, 1879	36,947.71		17,783.28		19,164.43				
5669	" " 1880	439,566.53		8,797.27	Credits to Dec. 31, 1904	430,769.26				
5669	" " 1881	241,333.11		125,299.44	" " "	116,033.67				
5670	" " 1882	69,774.55		11,100.20	" " "	58,674.35				
			$7,483,509.68		$1,301.880.07		$6,181,629.61	$4,375,238.31		
5670	" 30, 1883	156,915.37		6,525.02	Credits to Dec. 31, 1904	150,390.35				
5671	" " 1884	1,051,667.44		1,654.88	" " "	1,050,012.56				
5671	" " 1885	614,072.85		101,632.93	" " "	512,439.92				
5672	" " 1886	1,373,744.24		2,646.57	" " "	1,371,097.67				
5672	" " 1887	662,982.07		513.19	" " "	662,468.88				
5673	" " 1888	2,320,485.04		133,539.93	" " "	2,186,945.11				
5674	" " 1889	1,709,187.02		1,434.23	" " "	1,707,752.79				
5675	" " 1890	329,123.16		571.40	" " "	328,551.76				
5675	" " 1891	813,303.52		9,625.12	" " "	803,678.40				
5676	" " 1892	492,966.13		14,661.01	" " "	478,305.12				
5677	" " 1893	188,185.24		447.38	" " "	187,737.86				
5677	" " 1894	494,318.28		2,571.53	" " "	491,746.75				
5678	" " 1895	218,345.24		489.76	" " "	217,855.48				
5679	Dec. 31, 1895	377,749.95		7,675.99	" " "	370,073.96				
5679	" " 1896	448,486.38		550.45	" " "	447,935.93				
5681	" " 1897	731,421.47		998.11	" " "	730,423.36				
5682	" " 1898	1,207,574.32		33,131.86	" " "	1,174,442.46				
5683	" " 1899	744,131.44		6,064.01	" " "	738,067.43				
5683	" " " 1900	1,106,753.05		1,475.62	" " "	1,105,277.43				
5684	" " 1901	998,666.73		42,241.60	" " "	956,425.13				
5685	" " 1902	2,346,725.63		1,354,941.67	" " "	991,783.96				
5686	" " 1903	718,939.48		15,206.50	" " "	703,732.98				
5687	" " 1904	508,969.82		3,403.09	" " "	505,566.73				
			$19,614,713.87		$1,742,001.85		$17,872,712.02		$14,802,493.46	
	Grand Totals:		$27,098,223.55 Amount Charged		$3,043,881.92 Amount Credited		$24,054,341.63 Net Amount Charged			**$19,177,731.77

*This table contains no charges prior to the year ending June 1, 1866.

**This total includes no charges for any works constructed prior to June 1, 1865

Present Names of Charges and of Principal Groups of Works	Mr. Reynolds' Testimony	Years ending June 1st														Years ending June 30th				Totals	Totals of Principal Groups in First Column of Table VII	
		1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1879	1880	1881	1882			
	Pages	5345	5346	5347	5348	5349–50	5350	5351	5353	5355	5355–56	5357–8	5358–9	5360	5361	5668	5669	5660	5070			
"New Construction"	New construction																$1,027.94	$150,853.29	$32,542.84	$184,429.07		
	General expense											$57,193.95	$34,655.32	$250,520.31						372,369.58		
	General construction																	83,487.05		83,487.05	$887,878.28	GENERAL CHARGES
	Salaries	14,566.66	$ 16,358.26	$ 14,053.16	$19,811.66	$19,500.00						50,107.86	52,208.81	59,299.05						245,905.46		
	Instruments, Engineers' Department						$ 1,327.12	$ 300.00												1,027.12	..	$887,878.28
"Pilarcitos Dam" and reservoir	Main dam	102,741.96	45,011.78	85,614.32	3,074.96															237,043.02		
	Pilarcitos dam										33,352.82	536.49	613.70							34,503.01		
	Pilarcitos reservoir								2,402.25	1,470.00	637.39	1,804.47	2,066.01	3,782.00						12,162.12	294,261.35	
	Furniture Pilar Tools and Implements						10,553.20													10,553.20		
	Side Flume	4,610.35	2,254.75	6,764.68								3,887.60	9,638.28							27,155.66		
"Pilarcitos Tunnel No. 1" (exclusive of drifting and timbering)	Pilarcitos tunnel		2,733.05																	2,733.05	22,430.24	
	Tunnel No. 1						16,489.84	3,207.35												19,007.19		
"Pilarcitos Tunnel No. 2"	San Mateo and San Andres tunnel	10,535.05	25,906.00	31,182.86																73,023.91		
"Pilarcitos Pipe-line" (original)	Sheet-iron pipe and rivets		6,495.76			2,866.15														9,361.91		
	San Andres pipe-line			91,044.16	108,561.20															199,605.36	388,883.60	
	School-house pipe			101,193.52	40,335.28															141,528.80		
	Abbey pipe			25,561.49	12,823.04															38,387.53		
"Ocean House Flume"	Abbey Flume				9,233.41															9,233.41		
	Lake Honda Tunnel		13,088.00	35,203.94																48,291.94		
"San Andres Dam" (and reservoir)	San Andres reservoir			1,880.03	56,834.66	7,570.74	13,498.49	1,585.97	6,004.30	2,895.06	6,865.96	5,219.29	3,349.83	5,164.57						110,808.90	450,952.80	
	San Andres dam			558.92	144,982.15	44,360.60				483.97	116,114.33	33,515.38	68.50							340,083.99		
"San Andres Pipe-line" (original)	Bald Hill tunnel and brick					32,790.73	2,936.00	32.50												35,759.28		
	Bald Hill sheet-iron					20,379.77														20,379.77		
	Bald Hill rivets					1,849.44														1,849.44	355,636.97	
	Bald Hill pipe-line					6,435.00	296,596.05	456.86	938.06	9,802.97	1,602.14	3,559.33	2,333.68	2,683.62						324,407.76		
"Lock's Creek Line" (original)	Lock's Creek flume										1,378.67	1,073.35								2,457.02		
	Lock's Creek line						30,142.29	195,132.04	5,285.70	2,253.99	7,803.53	985.20	2,180.00	0,378.96						303,251.71	306,290.08	
	Lock's Creek tunnel					17.25			565.00											582.25		
	Crystal Springs upper dam											152,661.36	64,615.31	2,199.94						219,476.61		
	Lobos Creek tunnel							41,608.13												41,608.13		
	San Francisco City Water Works																					
	Reservoir City Water Works, City reservoir	92.50	262.85		1,806.20	205.43	7,151.37	12,069.58	11,043.34	11,718.44	12,123.19	10,802.73	10,218.70	11,914.43						80,413.81		
	Lombard Street reservoir														8,340.71					8,340.71		
	College Hill reservoir							5,197.63												5,197.63		
	University Mound reservoir																	3,880.00		3,880.00		
Part of "City Pipe System"	Pipe ordered and rent of yard		69,599.14	55,491.54	59,415.25	102,180.78	13,282.49	57,512.45	9,582.07	19,804.22	29,946.65	78,654.61	34,751.27							530,220.47		
	Laying pipe	9,444.70	10,969.73	22,599.61	21,950.44	45,609.98	25,625.64	28,304.45	34,118.29	29,108.06	11,929.09	23,006.69	35,490.87	16,394.85					13,273.61	327,836.01		
	Lake Honda main pipe		30,605.91	22,080.73	15,577.13	74,739.42														143,003.19	1,043,725.54	
	Lake Honda 22-inch main				1,326.06															1,326.06		
	Valencia Street pipe											39,819.81	1,520.00							41,330.81		
	Meters						26,219.91	2,239.04	2,593.60	6,411.22	5,058.04	6,682.35	13,013.68							62,217.84		SPECIFIC CHARGES
	Survey Calaveras												979.02							979.02		$3,487,360.03
	Totals	$147,991.22	$223,235.23	$493,341.96	$496,331.44	$367,505.34	$493,822.40	$347,646.00	$72,537.61	$83,947.93	$226,901.86	$469,515.57	$267,763.58	$391,337.73	$8,340.71		$1,027.94	$238,225.34	$45,816.45	$4,375,238.31	TOTAL	$4,375,238.31

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TABLE III

MR. REYNOLDS' TESTIMONY	YEARS ENDING JUNE 30th													YEARS ENDING DECEMBER 31st									Totals	TOTALS OF GENERAL CHARGES
	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	
Page	5670	5671	5671	5672	5672	5673	5673-4	5674-5	5675	5676	5676-7	5677	5678	5678-9	5679	5680-1	5681-2	5682-3	5683	5684	5685	5686	5687	
NEW CONSTRUCTION*	$ 105,899.73	$1,025,501.20	$ 172,32.57	$ 239,367.45	$ 205,208.29	$ 187,734.09	$ 260,890 79	$ 146,208.10	$ 247,325.73	$ 216,356.39	$ 173,390.52	$ 368,229.68	$ 149,626.65	$ 273,725.65	$ 208,198.24	$ 245,675.81	$ 272,065.02	$ 192,880.98	$ 98,837.84	$ 190,679.59	$ 257,209 28	$ 345,752.88	$ 252,720.61	$5,896,723 09	$5,896,723 09
Salaries of Engineers' Departme't — Included in respective charges for "New Const." *From '94 to 1904: Charged to operating expense														(2,219.65)	(6,958.29)	(6,650.00)	(6,073.56)	(5,500.20)	(5,916.45)	(6,135.10)	(8,695.95)	(7,150 05)		(26,730.00)	(82,726.25)	
Crystal Springs dam						—From 1883 to 1893, both inclusive—																		2,199,072 22	
Howard Cut, Crystal Springs				2,932.36	368,862.03	846,654 34	621,760.58	66,131 47	281,626.94		1,265.60	9,829.90												20,798 38	
Crystal Springs hotel													79.11	20,719.27										23,256 11	
Lower reservoir								4,650.37	18,605.74															19,536 74	
Crystal Springs pumping works						378.05	14,270.23	2,773.46	2,115.00															91,610 49	
Crystal Springs flume																	88,096.05	2,613.54						741.03	
Crystal Springs pipe-line	1,495 30	10,416.95	334,34 04	687,274 47	2,212.67																		741.03	1,036,183 43	
Islais Creek crossing																								44,322 01	
New Lock's Creek pipe-line																3.05			37,947.93	6,371.88				206,153 95	
Davis tunnel																2,972.97	166,791 61	36,389.37						32,287 08	
San Andreas forebay																20,396.78	8,453.29	3,437.01						14,983 29	
New San Andreas pipe-line																7,144.45	7,833.84							320,339 79	
Chenery street pipe														9,673.51	11,115 05	8,681.05	269,750 69	21,119.49						16,268 00	
Alameda pipe-line														4,273.67	11,904.33									1,586,869 30	
Belmont pumps						1,034,512.63	547,489.24	125.76	4,741 67															198,089 31	
Belmont boilers						81,575.11																		25,033 30	
New submarine pipe																			10,204.50	786 25	63,393.97	40,292.86	1,836 62	7,073 04	
New Alameda pipe-line																				7,445 28	1,261 70	9,254 58	7,073.04	286,342 52	
Calaveras dam																				144,671 00	140,589 62	1,075 31	6.89	347,201 99	
San Antonio					765.75																140,334 70	189,980 62	10,880 07	48,314 42	
Pleasanton wells																					3,185 84	40,228.50	4,134 33	4,330 47	
Filter beds																					4,330 47			82,709 07	
Sunol aqueduct																					64,641.21	18,067 86		235,030 47	
Millbrae pumps																					254,476.68	2,550 64	3 15	707,802 69	
Pilarcitos pumps																			248,291.70		151,917.25	1,126 64	3,467.01	261,219 98	
Oil installation																21.50	224,970.12	36,225.36						24,122 57	
Coal																23,687.38	435 19							23,224 68	
Lake Merced drainage																				12,258 97	7,770 50	3,105 21		48,484 86	
New Lake Merced pumps						14,828 04	17,452.42				3,924.58		5,076 06			520.92			6,082.24					210,660 29	
Ocean View pump													2,311.22	42,641 01	51,317.60	78,320.63	2,323.65			11,031 25	14,827 14	6,104 47	1,180.22	226,518 93	
Black Point pump									93,441.80	133,072.13														23,060 58	
Clarendon Heights pump									23,060.58															49,033 54	
University Mound											921.95	41,797.43	6,314 16											63,113 33	
Presidio Heights reservoir			100,998 19	77,469.81									29,170 73	9,020.12				9,208 20	10,604.14	5,609 84				178,468 30	
Potrero Heights reservoir																								28,406 77	
Lombard Street reservoir																					3,056.04	21,549 80	2,800.03	14,075 28	
Carville tank																10,250 00	3,825.28							7,353 71	
Pipe storage																							7,353.71	2,216 27	
Laying pipe																							2,216 27	16,064 40	
New Lake Honda pipe-line	17,296 92	5,224 74		49,529 27																984 00		1,174.59	13,905.75	72,050 93	
Bryant street stable																								57,077 99	SPECIFIC CHARGES
Stable equipment							25,737 79		46,702 61	10,306.77	8 61													27,039 74	$ 8,905,770 37
															1,301 95				391 93	1,175.81	463 36	1,094 65	234 87	6,323 76	
															1,406 35	423 29	1,135.50								
TOTALS	$ 124,691 05	$1,041,142 80	$ 608,305 10	$1,056,373 36	$ 577,048 74	$2,150,854 22	$1,484,985 67	$ 237,341.58	$ 717,620 07	$ 359,795.29	$ 179,511.26	$ 419,857.01	$ 192,578.53	$ 360,053 53	$ 345,333 52	$ 398,100 83	$1,047,186.14	$ 301,873 05	$ 413,050 42	$ 381,025.03	$1,415,448 66	$ 681,454 61	$ 308,661 10	$14,802,493 46	$14,802,493 46

AN EXPLANATION OF THE FOREGOING TABLES AND SOME OF THE DIFFICULTIES OR CONFUSION ARISING FROM CHANGES IN NOMENCLATURE OF PORTIONS OF COMPLAINANT'S WORKS AND FROM THE FAILURE TO SEGREGATE THE CONSTRUCTION ACCOUNTS, AND TO APPORTION THE COST OF ENGINEERING, ETC., AND CONTINGENT EXPENSES, ETC.

As in his testimony, on page 5347, Mr. Reynolds states that the larger proportion of the *contingent expense charges* are for interest charged, we have omitted them entirely from our Table II, although it is probable that the remaining smaller proportion of the same would contain charges that should properly belong to the *cost* of specific structures erected during these years. The years referred to, where the above charges to *contingent expenses* were made, and the respective amounts, are as follows:—

Year ending.	Contingent Expenses.	Charged directly to construction. Charges to Salaries not included.
June 1st, 1866,	$ 31,564.50	$ 133,424.52
" " 1867,	$ 32,982.99	$ 206,926.97
" " 1868,	$ 85,788.51	$ 479,188.80
" " 1869,	$ 78,997.06	$ 476,519.78
" " 1870,	$ 78,496.82	$ 348,005.34
Making a total of:	$307,829.88	$1,644,065.41

As above stated, it is probable that a portion of some of the direct charges for *construction,* amounting during this five-year period to $1,644,065.41, are included within the *smaller* proportion of the charges to *contingent expenses,* amounting for the same period to $307,829.88, the *larger proportion* of which charges, according to Mr. Reynolds, being interest charged; but, for reasons above stated, the *entire* amount of charges

to *contingent expenses* has been omitted from Table II.

As the construction of various important and extensive portions of complainant's works, continued not only through a period of several years, but were also charged in its books under various partly local denominations,—relating principally to the long wrought-iron pipe lines—and which former names in complainant's accounts, in latter years have been replaced by other more appropriate ones, we have, in Table II, grouped together all of the charges belonging to *each specific structure,* thus enabling us to arrive at the total amount charged or chargeable to each structure.

As an instance: the *Pilarcitos pipe line,* although testified to in this suit by Mr. Schussler under this name, regarding cost of reconstruction in 1903-04, according to Mr. Reynolds' testimony does not appear in complainant's accounts under *this proper name,* but instead, the charges made relating to its construction appear under the following heads:—

Year ending June 1st, 1867: "Sheet-iron pipe and rivets;
" " " " 1868: "San Andreas pipe line;
School-house pipe;
Abbey pipe."
" " " " 1869: "San Andreas pipe line;
School-house pipe;
Abbey pipe."
" " " " 1870: "Sheet iron pipe and rivets."

The above various local names were given in complainant's books to such portions of the *Pilarcitos pipe line* as were being constructed at or near the localities respectively named: San Andreas, School-house and Abbey.

Another instance of the use of the name of a certain locality for another important pipe line is the misnaming of the "*San Andres pipe line,*" which in complainant's older accounts appears there under the name of "Bald Hill pipe line"; this being the pipe line which received its water from the San Andres Reservoir after having passed through a tunnel constructed under a ridge known as "*Bald Hill.*"

The *Lower Pilarcitos Dam* and *Reservoir* appear in Table II under the heads of "Main Dam," "Pilarcitos Dam," "Pilarcitos Reservoir" and "furniture (Pilarcitos), tools and implements."

The San Andres Dam and Reservoir appear under these two respective heads, but the accounts do not state what portion of the charges made to "San Andres Reservoir" properly belong to the construction of the "San Andres Dam."

The following additional notes may be of assistance in better understanding the charges to the accounts of the respective items shown on Table II,—at the same time giving an idea of the difficulty encountered in arriving, from complainant's accounts, at the actual total original cost of the works testified to by Mr. Reynolds and enumerated on Table II.

The item "side flume," taken from complainant's accounts, means the "*Pilarcitos side flume,*" which, as shown in Table II, was constructed during the three years 1866-7-8, and reconstructed in 1876-7.

The two items "Pilarcitos tunnel" and "Tunnel No. 1" relate to the tunnel which forms the outlet from the gate-house in Pilarcitos Reservoir and is commonly known as "Pilarcitos Tunnel No. 1." This tunnel, having been drifted and timbered *prior* to June 1st, 1865 (the date of the beginning of the charges shown in Table II), does not therefore have its original

cost represented therein. The charge to "Pilarcitos tunnel" shown in Table II for 1867, relates to additional construction in this tunnel, while it was still in its timbered stage. The charges made to "Tunnel No. 1," as shown in Table II, for the years 1871-72, no doubt have reference to the *bricking* of this tunnel.

The charge under the head of "Abbey flume," appearing Table II., during 1869, relates to the flume replaced by what is now known and has been testified to as "Ocean House Flume."

Under the head of "Lock's Creek Tunnel," which relates to the construction of the original Lock's Creek Tunnel of 1871-72 (which tunnel is now known as and has been testified to under the name of "Lock's Creek Tunnel No. 1"), there does not appear a separate charge in the above extracts from Mr. Reynolds' testimony except in two small items in 1870 and 1873, and it is therefore probable that its cost has been charged in the lump sum charge: "Lock's Creek line"; while engineering and superintending expenses were probably charged to salary account as part of the operating expenses.

The cost of the Crystal Springs Pumping Works (being the original emergency pumping works), constructed there in 1877, although a very costly affair, appears in Mr. Reynolds' testimony, on page 5359, with a charge of only $3,893.92, which charge is only a very small fraction of the cost of this plant with all its machinery, boilers, foundations and building, and with its suction tank, long force pipe and flumes. The above partial cost of the same of $3,893.92 has been omitted from Table II; the balance or unmentioned portion of the cost of this entire plant being probably included in the large charges for "general expense and salaries" made during the years 1877 and 1878.

As during the same period of 1877 and 1878, the original "Lake Merced Pumping Plant" was constructed, which does not at all appear in Mr. Reynolds' above account for 1877 or 1878 of charges to "construction," it is probable that also this large expenditure has been included in the above two charges for "General Expense" and "Salaries" made during 1877 and 1878, which two items during these two years, as shown in Table II, amount to a total of over $426,000.

Another item on Table II, the College Hill Reservoir, by the smallness of the charge made for its construction, during 1872, according to Mr. Reynolds' testimony, page 5357, indicates that the bulk of the cost of the same, which does not specifically appear there, must have been charged to another account.

According to Mr. Reynolds' testimony, it does not appear in complainant's accounts what proportion of the accounts quoted by him under the head of "New Construction," "General Expense," "General Construction," "Salaries," "Instruments," "Engineer's Department," would be properly chargeable to the cost of construction of any or all of the structures enumerated in Table II.

The total amount charged to these accounts during the period from June 1st, 1865, to June 30th, 1882, being $887,878.28, and the total sum, as shown in Table II, of all charges made to construction during the above period from June 1st, 1865, to June 30th, 1882, and including the above total charges for "New Construction, general expense, general construction, salaries, instruments Engineer's Department," being $4,375,238.31, it appears that the total charged directly to the items of construction enumerated in Table II

amounts to the difference between these two totals, or $3,487,360.03, while the above total, charged during the same period for "new construction and general construction, general expenses, salaries, instruments for Engineer Department," amounts to the additional sum of $887,878.28.

In other words, the sum of these five charges represents the large proportion of 25.45 per cent of (and in addition to) the former direct charges.

From this showing, it appears quite evident that portions of some, or perhaps of most of the cost of construction of the specific structures enumerated in Table II are included in the latter charges, but their respective amounts or proportions cannot now be determined or segregated.

Table III, containing extracts from Mr. Reynolds' testimony, gives the amounts charged in complainant's books to the specific structures erected by the latter during the period from July 1st, 1882, to December 31st, 1904, both inclusive.

During this period the city distributing pipe system received a considerable addition, for which, in Mr. Reynolds' testimony, as shown in this table, no specific charges are made except as shown at the bottom of Table III by five charges made under the following heads:

Pipe storage	$ 16,064.40
Laying pipe	72,050.93
New Lake Honda pipe line	57,077.99
Bryant Street Stable	27,039.74
Stable equipment	6,323.76
Making a total of	$178,556.82

The item of New Construction, being the first charge in Table III, amounting for the period therein shown, from July 1st, 1882, to December 31st, 1904, to a total of $5,896,723.09, no doubt includes, among other charges, the amounts expended during this period for city pipe extension over and above the five items at the bottom of Table III, heretofore mentioned.

Table III shows that during the period from 1883 to 1893, while several large works were under construction, amounting to a total expenditure for these eleven years of $8,537,870.13, such salaries for the Engineering Department as should have been charged to the construction cost of the respective separate structures were charged instead to operating expenses.

In other words, if the proper proportion of the expense of the Engineering Department had been charged to the respective specific construction accounts, the cost charges for each of the structures erected during this eleven-year period would have been correspondingly increased.

From this showing, it is also evident that a portion or perhaps all of the remaining contingent and incidental expenses, which were incurred during this period, found their way into the "New Construction" account, which is included in the above total of $8,537,-870.13, and which, during this eleven-year period, amounted to $2,980,424.86.

As shown in Table III, the total direct charges for work constructed during the next following period, from July 1st, 1893, to December 31st, 1904, amounted to $6,264,623.33.

During this same period, the charges to "New Construction," which are included in this total, amounted to $2,916,298.23.

As will be seen in Table III, from 1883 to 1893 the salaries of the Engineering Department (instead of being charged proportionately to the specific structures) were not charged to construction account at all, but to operating expenses; while during the years from 1894 to 1904 an attempt has been made by complainant's accounting department to charge a portion of the cost of the Engineering Department to "New Construction" account, the total of these Engineer-Department charges so made during this latter period amounting to only $82,726.25 out of the total expenditures made for construction during this same period of $6,264,623.33.

This leaves no room for doubt that the remainder of the proportional cost of the Engineer-Department expenses, which would be properly chargeable to each specific structure erected, has found its way with other charges for incidental, contingent and superintending expenses into the apparently very large "New Construction" account, which, for this period, 1893 to 1904, as above shown, amounts to the large sum of $2,916,298.23 out of the corresponding total construction account, during the same period, of $6,264,623.33.

From the above showing, it appears that while during the entire period of construction of over twenty-two years, from 1883 to 1904, the total charges for constructed works amounted to $14,802,493.46, the total charge to this construction account, for salaries of Engineer Department, amounted to only $82,726.25, or a little over one-half of one per cent of the total expenditure charged to construction; which low percentage in itself is a proof that the so-called "New Construction account," as shown in Table III, includes, amongst other matters, the principal portion of the cost of the

Engineer Department, which should have been properly charged to each specific structure.

As heretofore stated, for the preceding periods, if the correct proportion of charges for incidental, contingent, engineering and superintending expenses, appertaining to each specific structure erected during the periods of Tables II and III had been properly apportioned and added to the respective cost charge of each specific structure, the totals so obtained in each case would then have more properly represented the cost of each structure.

With the comparatively small exception above shown, *sub* Table II (where Mr. Reynolds admits that the larger portion of contingent expense charges from 1866 to 1870, both inclusive, were for interest), no mention has been made in Mr. Reynolds' testimony on cost of construction, regarding interest during construction, the matter of interest charges having been given by him in his testimony as a separate account. As above shown, we have in the tables entirely eliminated all of Mr. Reynolds' figures for "contingent expenses." Thus no charges for interest during construction, appertaining to all or the separate structures enumerated in Tables II and III, are included in the cost charges contained in these tables.

Before proceeding with a preliminary discussion of the grouping, under specific heads, of the structures enumerated in Table III, or of the respective cost charges therein made for each structure, the following recapitulation of the foregoing results will show the proportion which all charges combined, between June 1st, 1865, and December 31st, 1904—which were made under the various separate heads of New Construction, General Expense, General Construction, Salaries and Instruments Engineers' Department,

and were charged to Construction Account—bear to the total amount charged to construction account for works erected during this entire period:

Table II: Total charges to construction account from June 1st, 1865, to June 30th, 1882	$ 4,375,238.31	
Table III: Total charges to construction account from July 1st, 1882, to December 31st, 1904	14,802,493.46	
Making a total of charges to construction account, from June 1st, 1865, to December 31st, 1904.		$19,177,731.77

Which total includes:

Table II: Charges to: "New construction, general expense, general construction, salaries, and instruments Engineers' Department," for the period from June 1st, 1865, to June 30th, 1882	$ 887,878.28	
Table III: Charges to: "New Construction" for period from July 1st, 1882, to December 31st, 1904	5,896,723.09	

Making a total of all the charges to new construction, general expense, general construction, salaries, instruments Engineers' Department, in Tables II and III, from June 1st, 1865, to December 31st, 1904, of..	$6,784,601.37

A comparison of these two totals shows that the charges of $6,784,601.37, made during the period from June 1st, 1865, to December 31st, 1904, under the head of "new construction, general expense, general construction, salaries, instruments engineers' department," amount to 35.37 per cent of the total of $19,177,-731.77 charged to construction account for the same period.

As all of the evidence deduced from the above analysis of Tables II and III goes to show that a large proportion, if not all, of the amounts for the periods comprised in Tables II and III, which are chargeable under the head of "incidental, contingent, engineering and superintending expenses," is contained and included in the amounts charged in these two tables under the heads of "new construction, general expense, general construction, salaries and instruments engineers' department," it is safe to say that (outside of other charges not specifically segregated to the respective structures to which they properly belong) the above total sum, charged during this period from 1866 to 1904 (as shown in Tables II and III), of $6,784,601.37, or 35 37-100 per cent of the entire amount charged to construction during this period—includes at least 10 per cent which should have been charged to the direct

cost charges for the structures enumerated in Tables II and III.

There appears, no doubt, that outside of such allowance for incidental, contingent, etc., expenses, the above total of $6,784,601.37 also, among other things, includes such portion of the cost of the city pipe extension during this period, as has not been accounted for in Tables II and III.

In Table II, a portion of the cost of the city pipe extension is shown under the heads of: "Pipe ordered and rent of yard; laying pipe; Lake Honda main pipe; Lake Honda 22-inch main; Valencia Street pipe," amounting to $1,043,725.54 for this period.

For the period from 1883 to 1904 (shown on Table III) only the following direct charges to city pipe extension are recorded under the heads of "pipe storage; laying pipe; New Lake Honda pipe line; Bryant Street stable; stable equipment," amounting to $178,556.82 for this period.

There appearing neither in Table II nor in Table III any specific charges to city pipe extension outside of the two amounts above quoted (namely, on Table II, $1,043,725.54, and on Table III, $178,556.82, making a total of $1,222,282.36), in the absence of any other provision in complainant's accounts for charges to city pipe extension for this period from 1865 to 1904 (see Table II and Table III), it is evident that the balance of the cost of city pipe extension during this period must be included (with a proper allowance, as above shown, for incidental, contingent, engineering and superintending expenses, and with other charges that have not been properly segregated to their respective structures) in the charges for new construction, general expense, general construction, salaries, instruments engineering department, which amount,

on Table II, to $887,878.28, and on Table III to $5,896,-723.09, or to a total for the entire period of $6,784,-601.37.

As positive proof that, outside of at least a 10 per cent allowance for incidental, contingent, engineering and superintending expenses, and outside of the cost of construction of the city pipe extension during the period from 1866 to 1904 (shown on Tables II and III), there is a large margin left in the above total charges, during this period, for "new construction, general expense, general construction, salaries and instruments engineer department" of $6,784,601.37, which margin will represent the total of the charges made to this general "new construction," etc., account, as belong to and should have been specifically charged to the respective structures erected (as enumerated in Tables II and III).

By referring to Tables II and III, it will be seen that during the period from 1866 to 1882 there was charged to "new construction, general expense, general construction, salaries, etc., $887,878.28, while during the period from 1883 to 1904 there was charged to "new construction" $5,896,723.09, making a total of $6,784,-601.37 charged to these general accounts.

During the same period, from 1866 to 1882, there was charged to specific construction accounts (Table II) $4,375,238.31, less $887,878.28, or $3,487,360.03, and during the period from 1883 to 1904 there was charged to specific construction account (Table III) $14,802,-493.46, less $5,896,723.09, or $8,905,770.37, making a total of $12.393,130.40 charged to specific construction accounts.

A comparison between the above total of $12,393,-130.40, of direct or specific charges, and the total of

$6,784,601.37, of general charges, shows that, in addition to the former amount the latter bears the enormous proportion of 54.74 per cent.

As above stated, during the entire period shown in Tables II and III, from 1866 to 1904, outside of the above quoted total of $1,222,282.36, there is no other direct charge made during this entire period for specific construction in the city pipe system or extension, which latter sum of $1,222,282.36 is included in the above total of direct charges of $12,393,130.40.

Analysis and Segregation of the Accounts, Showing What Portion of General Charges Are Properly Chargeable to City Pipe Extension.

This analysis will be made under the following heads: (A), (B), (C) and (D).

(A) On account of the fact that the cost charges of all of the city pipe extension (exclusive of the above $1,222,282.36), made during the period from June 1st, 1865, to December 31st, 1904, are included in the above total of general charges of $6,784,601.37, and in order to determine, as near as practicable, the amount contained within these general charges, but which properly belong to city pipe extension during this period prior to June 1st, 1865, it will be necessary to ascertain, as near as possible, the value of the city distributing pipe system at the beginning of the first period shown in Table II, extending from June 1st, 1865, to June 30th, 1882.

(B) Thereafter (in the absence of actual cost accounts), we will ascertain from complainant's testimony the value of the entire present city distributing pipe system.

(C) As this latter total includes the above cost charges of $1,222,282.36 for portions of the present

city pipe system, which charges appear in Tables II and III, the latter sum will be deducted from the present total value, ascertained from complainant's testimony; and from the balance so left will be deducted the value of that portion of complainant's distributing pipe system, as it was in 1865, at the beginning of the period shown in Table II.

(D) The final amount, so arrived at, will represent, as near as it can now be ascertained, a liberal estimate of the amount of direct charges that would belong to the city pipe extension account, during the period from 1866 to 1904 (shown in Tables II and III), but which amount, amongst other things, is included within the above total general account of $6,784,601.37.

In order to carry out the program of analyzing the question of city pipe extension, etc., as outlined under the above heads of A, B, C and D, we will first ascertain from complainant's testimony the amount of pipe of different diameters which, in the early part of 1865, constituted the city pipe distributing system of complainant.

A.

On page 1663 of Mr. Schussler's testimony he states on this subject:

> "The list of pipe as near as we have been able to take it out of the old books is as follows: That it, the pipe system of the Spring Valley Water Works at that time:
>
> 16-inch pipe ..... 450 feet
> 12-inch pipe .....23,434 feet
> 10-inch pipe ..... 1,643 feet
> 8-inch pipe .....41,674 feet
> 6-inch pipe .....77,130 feet
> 4-inch pipe .....75,957 feet
> 3-inch pipe .....19,169 feet"

The total length of complainant's distributing pipe system, therefore, at that time, was equal to 239,457 feet, or 45.35 miles.

On pages 1491 and 1492 of Mr. Schussler's testimony, he gives the lengths of pipe of various diameters in the city distributing pipe system as follows:

"Cast Iron Pipe.

3-inch pipe	130,930 feet
4-inch pipe	361,960 feet
6-inch pipe	572,220 feet
8-inch pipe	653,980 feet
10-inch pipe	8,490 feet
12-inch pipe	248,440 feet
16-inch pipe	122,890 feet
20-inch pipe	21,840 feet
22-inch pipe	19,180 feet
24-inch pipe	34,840 feet
30-inch pipe	4,490 feet

Total cast iron pipe: 2,179,260 feet, or 412,74 miles."

"Wrought Iron Pipe.

13-inch pipe	850 feet
22-inch pipe	25,481 feet
30-inch pipe	12,742 feet
33-inch pipe	2,510 feet
37 1-2-inch pipe	12,254 feet
44-inch pipe	7,213 feet

Total wrought iron pipe: 61,050 feet, or 11.56 miles.

Total lengths of city distributing system:

Cast iron pipe	412.74 miles
Wrought iron pipe	11.56 miles

Total length on July 1, 1904...424.30 miles."

Regarding the length of the city pipe system in 1865 and 1904, respectively, the above figures show that the

total length in the former year represented 10.68 per cent of that in the latter year.

Regarding the probable cost, at that time, of the above pipe system of 1865, complete in the ground, we find no specific account in complainant's books. Cast iron pipe, at that time, was much dearer than now, and although labor was cheaper than in 1903-1904, the following estimate being based upon present cost of the pipe, complete in the ground (the physical conditions of the streets then being taken as equal to the least expensive construction at present) will fall below the actual cost in and before 1865.

The city pavement, at that time (in 1865) consisting principally of macadam and some little planking and cobbles, we will come very close to the total cost of the complete system at that time by adopting Mr. Schussler's estimate for cast iron pipe, complete in the ground, as shown in his testimony on pages 1493, 1494 and 1495.

On account of the fact that in and prior to 1865 the ground below the pavement was practically free from obstruction, and comparatively easy to excavate, the lowest schedule of cost estimates for cast iron pipe, complete in the ground, as detailed on pages 1493 to 1495 of Mr. Schussler's testimony, have been adopted in the following estimates (which include 10 per cent for incidental, contingent, engineering and superintending expenses):

"Cast Iron Pipe.

Page 1493:	3-inch pipe	55 cents a foot
	4-inch pipe	75 cents a foot
Page 1494:	6-inch pipe	$1.20 a foot
	8-inch pipe	1.70 a foot
	10-inch pipe	2.70 a foot
	12-inch pipe	2.90 a foot
Page 1495:	16-inch pipe	3.90 a foot

By placing these cost figures per lineal foot of pipe, complete in the ground, opposite to the various lengths of pipe of the respective sizes, we have the following result as to respective and total estimates of cost for 1865, which figure includes, as above stated, 10 per cent for incidental, etc., expenses:

3-inch pipe,	19,169 feet @	$ .55	$ 10,542.95
4-inch pipe,	75,957 feet, @	.75	56,967.75
6-inch pipe,	77,130 feet @	1.20	92,556.00
8-inch pipe,	41,674 feet @	1.70	70,845.80
10-inch pipe,	1,643 feet @	2.70	4,436.10
12-inch pipe,	23,434 feet @	2.90	67,958.60
16-inch pipe,	450 feet @	3.90	1,755.00
Total	239,457 feet	.....	$305,062.20

As this total estimate includes 10 per cent for incidental, contingent, engineering and superintending expenses, in order to obtain the above estimate without such charge of 10 per cent we deduct from the entire sum of $305,062.20 one-eleventh of the same, or $27,732.92, which leaves $277,329.28, or, in round figures, $277,300.00, as the probable direct cost (without the 10 per cent addition for incidental, etc., expenses) of the city distributing pipe in 1865.

B.

Regarding the estimated present value or cost of reproduction in 1903-04 of the entire city distributing pipe system, as now existing, we have, in Mr. Schussler's testimony, on page 1501, the following total: $5,780,700, which sum includes for special structures on this system the sum of $80,500, and also includes an allowance of 10 per cent (for all the work included in the above total), for incidental, contingent, engineering and superintending expenses.

This latter percentage, amounting in round figures to $525,500.00, when deducted from the above sum of $5,780,700.00, leaves a total balance (exclusive of the above 10 per cent for incidental, etc., expenses) for the entire present city distributing pipe system of $5,255,200.

C.

Under this head the total amount appearing in Tables II and III amongst the direct charges in complainant's accounts, charged towards the city distributing pipe system, of $1,222,282.36, will be deducted from the above total sub. B of $5,255,200.00, which leaves a balance of $4,032,917.64, or, in round figures, $4,032,900.00.

From this sum of $4,032,900.00 will be deducted the value, as above estimated, for that portion of complainant's distributing pipe system, as it existed in 1865, at the beginning of the period shown on Table II, amounting, as shown sub. A, to $277,300.00.

$4,032,900.00, less $277,300.00, leaves $3,755,600.00.

D.

This amount of $3,755,600.00 (sub. C) represents, as near as can now be ascertained, a liberal estimate of

the total amount of direct charges properly belonging to the city pipe extension account for the period from June 1st, 1865, to December 31st, 1904 (as shown in Tables II and III), but which latter amount is included within the above total charges in Tables II and III, made to the general accounts of:

"New construction;
General expense;
General construction;
Salaries;
Instruments engineers' department."

amounting to a total of $6,784,601.37, or, in round figures, to $6,784,600.00.

By deducting from this total of.....$6,784,600.00
the above total (sub. C) for balance of city
pipe extension during period from 1866
to 1904 (see Tables II and III) of..... 3,755,600.00

we have $3,029,000.00

which latter balance, left from the above general "new construction" account of $6,784,600.00 (besides a proper allowance of at least 10 per cent for incidental, contingent, engineering and superintending expenses), also includes such portions of the direct charges as properly appertain to most or all of the direct charges (testified to by Mr. Reynolds as taken from the accounts of complainant's accounting department) as enumerated in Tables II and III.

As above shown, the sum total of all of the direct charges enumerated in Tables II and III amounts to $12,393,130.40.

An allowance of 10 per cent on this sum, for incidental, contingent, engineering and superintending expenses, amounts to $1,239,313.04, or, in round figures, $1,239,000.00.

By deducting this latter amount from the above balance of the general "new construction" account, we have $3,029,000.00, less $1,239,000.00, or $1,790,000.00, which represents, as near as it can be ascertained, the total amount of that portion of expenditures for "new construction" (included in the general "new construction" account of $6,784,600), during the period from June 1st, 1865, to December 31st, 1904, which was not properly charged to the specific structures, to which they belong, that were erected during this period.

As above shown, the total of all of the direct charges to the structures enumerated in Tables II and III amounts to $12,393,130.40.

To this sum, the above balance (contained in the general new construction account) of $1,790,000.00, bears a relation of 14.44 per cent in addition to the former, and amounts to practically one-seventh (1-7) of the same; while the above total balance of $3,029,-000.00 bears a relation to the total direct charges of $12,393,130.40 of 24.44 per cent, or nearly one-quarter (1-4) of the same.

THE REASON WHY THESE CHARGES DO NOT APPEAR TO BE SEGREGATED ON COMPLAINANT'S BOOKS OF ACCOUNT AND WHY MR. SCHUSSLER, AS HEAD OF THE ENGINEERING DEPARTMENT, COULD NOT BE EXPECTED TO GIVE THE EXACT DETAILED COSTS FROM COMPLAINANT'S BOOKS AS DEFENDANTS' COUNSEL CLAIM HE SHOULD HAVE DONE.

From what has so far been shown by the above partial analysis of the various items of direct charges made to specific structures by complainant's accounting department, and of the groups of charges at the top of Table II under the various heads of "New Construc-

tion, general expense, general construction, salaries, instruments engineering department;'' and at the top of Table III, under the head of ''New Construction,'' it appears that these portions of the charges for construction were used by complainant's accounting department as a convenient receptacle into which the secretary, who had charge of complainant's accounts, placed all construction charges of which he either did not know or did not ascertain the respective account to which the doubtful charge properly belonged.

A secretary's duties necessarily confine him to his office. It is no part of the duty of any secretary as such to visit the works on which his corporation is engaged during their actual construction; and where a corporation is engaged in the construction of different structures all forming part of one system, it would necessarily be difficult if not impracticable in many cases for him to apportion many general accounts between the various parts of the system.

Besides this difficulty, the fact that the various successive secretaries, who had charge of the complainant's accounts during this long period, frequently changed the method of accounting that had been adopted by their respective predecessors (as is shown by the testimony of the expert accountants), still more complicated the situation.

The purchasing agent of a corporation would probably know the exact cost of the materials purchased by him from time to time, but he would not necessarily be familiar with the construction of the works in which such materials were used nor with the exact proportional distribution and segregation of the materials to the various separate structures going on at one and the same time and often in close proximity to each

other, nor with the labor-cost as distributed over these various works.

The Engineering Department, as shown by the testimony, and as would be apparent to any court even without testimony, has nothing to do with the keeping of accounts.

Under these circumstances, when it came to the question of determining the value of the works, early in 1904, for water-rate fixing purposes, the only course was for the engineering department to make an independent estimate of such value.

As above shown, the approximate estimate of February, 1904, for the Supervisors, although made on very short notice and within the time of only five days, still gave a fairly close approximation to the values of the structures.

When, during the same year, it became necessary to make more precise, exact and detailed estimates for the purposes of this suit, Mr. Schussler testifies, as we have seen, that he did make a very thorough, detailed estimate of each specific structure, as to dimensions, quantities of materials and labor, that would be required if these works were to be reconstructed under the conditions ruling in 1903-04, and of what each structure would cost under those conditions.

In doing this the more carefully segregated accounts of some of the more recent structures, such as the forty-four-inch San Andres and the fifty-four inch new Alameda pipe line (which last account related to a very recent period of construction) were of great value. As to the fifty-four-inch pipe, he was able to give the exact cost. The Secretary's account of cost of the forty-four-inch San Andres pipe line, which was constructed prior to the large increase in

the cost of an hour's labor, was of use by Mr. Schussler more for a purpose of comparison with his own memoranda in arriving as close as possible at what the average cost of this and other pipe lines would be, if constructed in 1903-4.

Other data, such as the actual performance, in a given time, of brick-layer's work, under the present state of organized labor, and if compelled to do the first-class quality of work demanded by complainant, and do it by day's work and not by contract, were gathered from notes and memoranda kept by the engineers' department of quite a large piece of brickwork in the Lombard Street reservoir, constructed during 1903-4. This information, so gathered, was of value in making other estimates of brickwork, as not only were the wages now demanded by bricklayers and their helpers determined, but also the proportion and character was settled of the help allotted to each bricklayer. The work on this Lombard Street reservoir also furnished the engineering department with data regarding the average number of brick laid by each bricklayer per eight-hour day and per hour, and as in this case the engineering department had access to the cost of all materials, teaming and other labor employed in this work, Mr. Schussler had an excellent chance to determine the cost of such work under the present conditions of cost of materials and organized labor.

As furthermore, this reservoir was comparatively shallow, open and the work very accessible throughout, it gave an excellent criterion for arriving at the cost of the actual hourly performance of bricklayers under the present conditions of labor in other portions of complainant's works.

Mr. Schussler was aided, too, in making his estimates for 1903-04 by the intimate knowledge of each structure that he had acquired in the long period during which he had planned and designed the works and watched their construction so as to know the quality of the materials and workmanship employed; and by his knowledge and understanding of the gradual development and evolution of the labor situation from the condition prevailing through by far the largest portion of complainant's construction era, where each man worked ten hours a day at a cost which, if reduced to the hour's performance, averaged barely two-thirds of the present cost.

INSTANCES OF SPECIFIC STRUCTURES AS TO WHICH THE AMOUNTS CHARGED TO CONSTRUCTION DO NOT REPRESENT THE COMPLETE COST OF THE STRUCTURES MENTIONED.

Although, judging by the construction charges, as tabulated in Table III, from Mr. Reynolds' testimony, a greater degree of care appears to have been taken by complainant's accounting department in the distribution and segregation of the charges to specific structures than during the preceding period comprised within Table II, still, quite a number of the charges segregated on Table III show that they do not represent the complete cost of the structures enumerated therein.

Crystal Springs Pumping Works.

In one case, the Crystal Springs pumping works, during 1898 and 1899, are charged in Table III with an expenditure of only $91,610.49, which either excludes the cost, in a large amount, for the heavy cast-iron force-pipe, taken from stock on hand in San Francisco,

or (excepting a charge of $741.03) the cost of several miles of flume connecting the triple force-pipe line with the Lock's Creek aqueduct, or the cost of portions of both, or other expenditures made in and adjoining the pumping station; and no doubt includes but a trifling, if any, charge or incidental, contingent, engineering and superintending expenses.

Crystal Springs Main Dam.

In the case of the Crystal Springs main dam, the expenditures made on Howard Cut during 1890 and 1891 do not appear under this separate charge; nor does a considerable expenditure, made during the same years at the Upper Crystal Springs dam for raising the same, appear in Table III under this separate head.

It is therefore evident, that the sum total of charges to Crystal Springs dam, made as shown in Table III, during the years from 1886 to 1891, and which charges, without the $23,256.11 charged to "Crystal Springs Hotel" (meaning men's boarding house) amount in round figures to a total of $2,188,000, and probably also include the expenditures, or a portion of the expenditures, made during the same period on account of "Howard Cut" and upper Crystal Springs dam.

During this same period, as shown in Table III, all salaries of the engineering department were charged to "operating" and not to construction account.

Alameda Pipe Line and Appurtenances.

During the five years from 1887 to 1891, while the heavy portion of construction at Crystal Springs dam and on Alameda pipe line and appurtenances was going on, the charges to "New Construction" (not segregated to specific structures) amounted to the large sum of fully $1,047,000.00, and it is very probable that

a portion of the amount that should have properly been charged to the specific cost of the main Crystal Springs dam is included within the above large total charge for "New Construction."

During the same period,—specifically, during 1888 and 1889,—the construction of the Alameda pipe line, with the first double submarine pipe and the original Belmont pumping plant was also being carried on. It is therefore probable that the above total charges for new construction, of about $1,047,000.00, not only include portions of the charges that properly pertain to the direct construction cost of the Alameda pipe line and appurtenances, but that (as all salaries of the engineering department, while these costly constructions were going on, instead of being charged to the specific construction account, were charged to operating expenses) most, if not all of the charges for incidental, contingent and superintending expenses, found their way into the above large "New Construction Account."

Belmont Pump.

As shown in Table III, and as will be hereafter touched upon, the cost of construction of the original Belmont Pumps, erected during 1888, is quoted at only $81,575.11. This station (prior to its increase in capacity during the period from 1900 to 1904), having cost a very much larger sum than the above charge in 1888, there is no doubt that the balance of its original cost is mostly charged in with the Alameda pipe line (which was under construction at the same time) and that (engineer's salaries having been charged to operating expenses),—the remaining incidental, contingent and superintending expenses may be included in the "New Construction" charge.

Crystal Springs Pipe Line.

For the Crystal Springs pipe line, the construction of which extended through the years from 1883 to 1887, the Table III shows a total of direct charges of $1,036,-163.43.

During the three years from 1884 to 1886, while the bulk of this expenditure was being made, and during which three years no other construction of magnitude was going on, except the University Mound Reservoir and some main pipe laying, both in San Francisco, the "New Construction" account (for these latter three years) shows the enormous total of $1,437,411.22.

This large charge for unspecified "New Construction" indicates that, in all probability, outside of city pipe extension, it includes not only charges belonging to "Crystal Springs pipe" and University Mound Reservoir accounts, but also most, if not all of the proportionate charges for superintending, incidental and contingent expenses; (the engineers' salaries having been separately charged to operating expenses, instead of to the construction account of each specific structure).

Fifty-four-inch Alameda Pipe Line.

The direct charges to the new fifty-four-inch Alameda pipe line, which was constructed during the years from 1902 to 1904, amount to a total of $347,-201.99, as shown on Table III. This work was constructed during a period when the cost and conditions of labor were practically the same as during the period of 1903-04, for which Mr. Schussler's estimate of cost of reconstruction was made. The engineering department therefore had an opportunity to satisfy itself

that the charges for construction for this particular work were made by complainant's accounting department with a fair degree of accuracy,—except as to the proper additional charges for incidental expenses,—and except also that, amongst other things, the cost of such pipes and fittings as were taken from the stock on hand in complainant's pipe yards, was apparently not charged in.

It appears that the above cost account of this structure comes quite close to (although somewhat above) Mr. Schussler's estimate of the same work for 1903-04. The amount of the direct cost charges by complainant's accounting department for this pipe line is $347,-201.99, while Mr. Schussler's corresponding estimate of this pipe line, detailed on pages 1202-1203 of his testimony, including extra pipes, fittings used and work done for extra connections at Burlingame and Millbrae, exclusive of ten per cent allowance for incidentals, etc., amounts to $326,200.00. In order to arrive as near as possible and practicable at a correct value of the various pipe lines, Mr. Schussler established an average figure for all of these pipe lines as to the cost per pound of plate iron used in their construction, thereby and by the weight of the plate-iron used and other expenditures, determining the average cost of reconstructing all of complainant's wrought iron conduit lines in 1903-04, although, as will be shown, the cost of some of the older and main pipes averaged a higher figure than 10.60 cents. In the new 54-inch Alameda pipe line, the cost per pound of plate iron of the pipe line, when completed, was really greater than 10.60 cents per pound as will be shown hereafter; but Mr. Schussler, having adopted in his estimate the above standard of 10.60 cents per pound for all of com-

plainant's main wrought-iron conduit lines, the new Alameda pipe line, although costing more, was also figured at this rate. This is one of the causes of Mr. Schussler's estimate of this line being below the direct cost charges made by complainant's accounting department.

Filter Beds and Sunol Aqueduct.

Another very prominent series of structures completed during recent years is the work done during the period 1900-1902 and 1903-1904, as shown in Table III under the heads of "Filterbeds" and "Sunol Aqueduct." The respective amounts charged by complainant's accountants to these two separate accounts (probably owing to the contiguity and interlacing of these two works) have evidently been more or less mixed up with each other, in that the "Sunol Aqueduct" is there charged with a great deal more expenditure than it cost, while the cost of the "filterbeds" is placed considerably below its actual cost. At the same time, the figures given for these two items do not indicate whether, or what portion of the cost charges of this important group of works is included in the unsegregated "New Construction Account" which, during the two years of 1900 and 1902, when the bulk of this construction was going on, amounted to over $356,000. As shown in Table III, and even without adding any allowance for incidental expenses, from the above separate "New Construction Account," the charges to these two groups of works are as follows:

"Filterbeds $255,030.47
Sunol aqueduct $707,802.69
Total .....$962,833.16"

Mr. Schussler's estimate for this work is as follows:

Pages 1111 and 1112 of his testimony—

"Recapitulation of the Sunol filterbeds, inclusive of the Laguna ditch, with which I began this description; all of these figures include the 10% for incidental, contingent, engineering and other expenses, tools, boots, etc.

Upper and lower filter-galleries, including main excavations and timbered cuts and excavation of the concrete filter-galleries	$186,000.
Concrete filter-galleries	116,000.
Rails, I-beams and gates	4,300.
Galvanized pipes, manholes	3,300.
Gravelling filter pipes, refilling gravel on top of tunnel and refilling topsoil over the concrete filter tunnels	14,000.
Original Sunol dam and addition as at present	40,000.
Buildings	9,000.
Adding to this the Laguna Creek ditch as above enumerated	29,300.
We have a total of	$401,900.

or, in round figures, $402,000, as the total of the Laguna Creek and Sunol filterbeds, including the Laguna ditch, with all its appurtenances, and including 10% for incidental and contingent expenses, etc."

Pages 1129 and 1130—

"Recapitulation of Sunol Aqueduct, including the Niles screen-house and including 10% allowance for incidental, contingent, engineering, superintending and other expenses:

Sunol aqueduct tunnels drifted, timbered and concreted complete, inclusive of blow-off, tunnels, manholes, etc.	$401,500.
Sunol aqueduct flumes complete, inclusive of concrete chute, measuring-tank, and keeper's house	60,000.
Niles screen-house, inclusive of screen-tender's house	8,800.

Total, Sunol aqueduct, complete..... $470,300., or, in round figures, $470,000, which includes all of the work from the westerly end of the Sunol Dam to and inclusive of the Niles screen-house complete, with appurtenances."

Adding together Mr. Schussler's above estimates, both including ten per cent for incidentals, etc., of these two contiguous groups of works on the Alameda Creek System, we have:

Sunol filterbeds	$402,000.
Sunol aqueduct	$470,000.
Making a total of	$872,000.,

against the total charges to these two groups of structures, by complainant's accountants, as shown in Table III, of $962,833.16.

Although this latter total evidently does not include all proper proportionate charges to these two accounts for incidental, contingent, engineering and superintending expenses, still, a comparison between these two totals shows, even without this latter allowance, that Mr. Schussler's estimate of cost of reproducing these two groups of works, under the conditions ex-

isting in 1903-04, is fully $90,000 lower than the total shown by complainant's accounting department.

It would take too much time and space to go into the same detail regarding all the other specific charges taken from complainant's accounts, and shown not only on Table III but also on Table II; but enough has been shown of the manner in which they were kept, especially referring to the segregation of the actual complete costs of each specific structure, that these accounts would give but a very incomplete basis (to say the least) for anybody, no matter how expert, in such matters, to ascertain from them the actual original cost of each specific structure.

Defendant, in preparing its brief, has arrived at what it calls original cost by resorting to a conglomerate of quotations, partial quotations and misinterpretations of testimony, supplemented by quotations from old minute books of complainant's Boards of Directors, and testimony of men who, several decades ago, worked for complainant, either as contractors or by day's work, none of whom have for many years had any connection whatsoever with complainant's works, or knowledge of the cost of their construction. Mr. Schussler, who designed and constructed practically all of the works enumerated in Tables II and III, and was familiar with their every detail, saw that the best possible method of arriving at the cost of reproduction of these works, under the conditions governing in 1903-04, was, to ascertain as near as practicable the quantities of materials contained and used in the various structures, and the labor and cost of labor that would be required to reproduce them in 1903-04 with the same degree of thoroughness as shown in their original construction.

VI.

Analysis of the Proper Cost Charges of Complainant's Various Structures by the Aid of the Foregoing Tables I, II and III, and Mr. Schussler's Testimony, Shows an Actual Average Cost Greatly Exceeding 10.6 Cents per Pound for Wrought-Iron Pipe Complete and Laid in the Ground.

In the following analysis, the principal features of the cost of reproducing complainant's works will be discussed with such light as can be thrown on the same by reference to complainant's cost accounts, as shown in Tables II and III.

The total estimated cost of complainant's large, wrought iron pipe lines (comprising not only the long lines conducting water from head-waters into the respective city reservoirs, but also those pipe lines employed in the aqueducts connecting together various groups of headworks; and also wrought iron suction and force pipe lines at various pumping works, as well as wrought-iron main distributing pipe lines in the San Francisco city distributing system) represents the large total of over $4,000,000. Therefore, in the following discussion of complainant's works, we shall begin with its wrought-iron pipes.

To show that proper economy was constantly practiced by complainant in the construction of its works, although the first-class quality of materials and workmanship occupied the first place in its requirements, the following paragraph of Mr. Schussler's testimony is here quoted: (Testimony p. 708.)

A. "Nobody who has not been present during the construction of all of these works in all their details can judge these works simply from their outside

present appearance, nor can he judge with what extreme care the materials used in the construction have been selected, prepared and placed in the work. As the only watchword through all these forty years has been 'good work,' the question of expense was a secondary consideration, although proper economy was always practiced, with all of the other work performed, as we saw to it that each man and team did a full day's work.''

As heretofore shown from the testimony when, in a few instances, the high grade plate-iron, used in nearly all of complainant's main pipe lines, was not obtainable in time to complete the proposed line, materials of a cheaper grade but of good quality had to be used in such emergencies. In Mr. Schussler's estimates allowance has been made for the cheaper purchases of iron, in arriving at the average standard price per pound of plate iron adopted by him.

As hereinbefore stated, defendants' counsel in their brief, have attempted by their method of collecting partial quotations, fragmentary and partial data, and by their own combination of such collection and their own methods of computation, have arrived at certain results regarding the cost of works, or their interpretation of Mr. Schussler's testimony, as tabulated in their tables 6, 7 and 35, and have from these results, so obtained, drawn such erroneous and misleading conclusions and deductions, that the only course left for complainant is to quote from Mr. Schussler's testimony the correct and full data given by him, in order to show what he actually did say, and intended to convey.

As previously shown, there are no data at hand relating to the detailed cost of the original Pilarcitos and San Andres pipe lines constructed during the lat-

ter part of the sixties and the early seventies, respectively. (See complainant's Table II.) Regarding these two original lines, it is known and so stated by Mr. Schussler that the material and workmanship were of the best obtainable at that time. This is borne out and proven by their serviceability and durability for the many decades since their construction. The route of both these lines is known, and it appears that a large portion of each was on land, steep and difficult of access, as also shown on complainant's exhibit No. 22.

Regarding the quality of and the price paid for the high grade laminated iron used in both of these lines, Mr. Schussler's testimony is quoted below. The main cause why the iron used in the construction of the original Pilarcitos as well as of the San Andres pipe line cost and was worth more than ordinary wrought-iron, commonly known as pipe iron, was that the method of manufacture prescribed by Mr. Schussler required a more costly process than that used for the latter class of iron. This is shown in the following quotation from Mr. Schussler's testimony, which he gives in relation to the plate-iron used in the original Pilarcitos 30-inch pipe line:

> "It was rolled in Scotland. It was the first laminated iron that I introduced here from there for our purpose, and in those days we had it rolled out first into bar iron, long flat bars, 40 or 50 feet in length, eight inches wide, and from five-eighths to three-quarters of an inch thick. Those were cooled and then sawed off to a length which would equal the future width of the plate. These bars were piled on top of each other, wired together, heated in the furnace to a white heat and then passed through the rollers sideways, until they had been squeezed down

so that the width had been drawn out about to equal the width of the future sheet; then this slab, which had now come down to a thickness from five-eighths to three-quarters of an inch, or a little more, was suddenly turned around half ways and was passed through the rollers again longitudinally, with the original grain of the bundle of bars, thus giving not only a good grain sideways, but an excellent grain lengthwise. We kept on with this method, which cost us something extra, but which had a great many advantages that I will detail hereafter, until, of late years, it was superseded by a method of making these piles in the rolling mills in a somewhat different way."

On page 780, Mr. Schussler says, regarding the durability of the above iron:

"If, instead, we had tried to save money at the beginning—perhaps a cent or a cent and a half a pound in the original cost of the iron—that pipe would have been destroyed probably once or twice since, and would have had to be renewed entirely since the beginning."

Of the same pipe line, Mr. Schussler also states, on the same page:

"Pipes that were laid in 1866 or 1867, or from 37 to 38 years ago, are today in full operation under a big pressure."

Regarding the same quality of plate-iron used in this original 30-inch San Andres pipe line, which, as shown in complainant's Table II was constructed a few years after the Pilarcitos pipe line, Mr. Schussler states on page 2275 of his testimony:

"For that iron we paid at that time between 5 and 6 cents a pound, if I recollect right. It was imported from Scotland."

In the absence of any account record giving the cost per pound paid by complainant at that time for the plate-iron composing these two original long 30-inch pipe lines, namely the Pilarcitos and the San Andres pipe lines, we now refer to the extracts from Mr. Reynolds' testimony, as shown on complainant's Table II, relating to the charges made by complainant's accounting department, as giving the total original costs complete in the ground of each of these two original pipe lines.

Table II gives the following cost charges relating to these two pipe lines:

PILARCITOS PIPE LINE.

		Cost:
Original Pilarcitos pipe line, being carried by complainant's accounting department under the following heads:	Sheet iron pipe and rivets, San Andres pipe line, Schoolhouse pipe, Abbey pipe,	$388,883.60

SAN ANDRES PIPE LINE.

Original San Andres pipe line, being carried by complainant's accounting department under the following heads:	Bald Hill sheet iron, Bald Hill rivets, Bald Hill pipe line,	$355,636.97

In order to determine the cost per pound of plate iron used in these two pipe lines, for the pipes complete in the ground, we will ascertain from the evidence and exhibits filed, as near as possible, the total weight of plate iron used in each of these two pipe lines.

Thereafter, by dividing such total weight for each line into the respective total direct cost charges of each line, we shall very closely ascertain the average cost charge per pound of plate iron for each of the complete original pipe lines.

THE ORIGINAL 30-INCH PILARCITOS PIPE LINE.

The Cost of This Was Really 13.67 Cents Per Pound of Wrought Iron Pipe.

Mr. Schussler's testimony relating to the present and the original status of the Pilarcitos pipe line is as follows (Test. p. 784):

"This main Pilarcitos pipe line consists of three different kinds of pipe.
It consists of 30-inch wrought iron pipe, of a length of ..... 65,170 feet
It consists of 22-inch wrought iron pipe of a length of ..... 2,400 feet
It consists of 24-inch heavy cast iron pipe of a length of ..... 776 feet

Total ..... 68,346 feet"

Neither Mr. Schussler nor Mr. Reynolds, in their testimony, make reference to the year in which the above 2,400 feet of 22-inch wrought iron and 776 feet of 24-inch cast iron pipe were laid. The former's testimony, referring to this matter, is as follows (Test. p. 2170):

X. Q. 2748: "Is there any other way that you can tell when that pipe line was finished?"

A. "I have no doubt the Secretary can tell you when the last payments were made, and when the

payments were made. The construction of that pipe was scattered through a number of years, but I do not recollect exactly now how many years; in fact, we relaid a portion of the pipe some years later with cast iron pipe in the crossing of the San Andres Valley. I believe the Secretary would be the most likely party to get at the time and the date of the finishing of that pipe."

Another reference to the relaying of a portion of the 30-inch Pilarcitos pipe line, where it crossed the San Andres Valley, occurs in Mr. Schussler's testimony as follows (Test. p. 2463):

X. Q. 3839: "In laying the Pilarcitos pipe line, what was the character of land through which it was laid? Have you any details of that"?

A. "No sir. That pipe was laid many years ago. The southerly portion of it was laid about the year 1868—37 years ago—and the northerly portion was laid a year or so earlier. The general character is, though, as you find it there now; the upper portion, as we crossed the San Andres Valley, had a steep slope on the westerly bank, and not quite as steep a slope on the easterly bank of the San Andres Valley. A portion of that pipe has been relaid since in a trench cut alongside of the old pipe and then connected with the old pipe."

As no separate account appears in Mr. Reynolds' testimony, as tabulated in complainant's Tables II and III of the cost of reconstructing "some years later" the above portion of the original Pilarcitos 30-inch pipe line where it crossed the San Andres Valley, it may be presumed that the expenditure that would have been required to replace the original 30-inch wrought iron pipe there in its original condition, was charged to operating expenses, while any excess cost, over and above such simple renewal cost, was proba-

bly charged to "New Construction" account during the year this alteration was made.

On page 786 of Mr. Schussler's testimony, the weight of plate iron in the at present remaining 65,170 feet of original Pilarcitos 30-inch pipe line is given at 2,711,-000 pounds, making an average of 41.6 pounds of plate iron per lineal foot of pipe.

In order to arrive at the total weight of plate iron in the entire original 30-inch Pilarcitos pipe line, laid as above shown from Mr. Reynolds' testimony and as verified from complainant's Secretary's account, on page 74 of Appendix to Municipal Reports of 1900-01 (and laid prior to the replacement of the original 3176 feet of 30-inch Pilarcitos pipe at the San Andres Valley crossing by 22-inch wrought iron and 24-inch cast iron pipe), we have to add to the above 2,711,000 pounds (which represent the weight of plate iron in the remaining 65,170 feet of 30-inch Pilarcitos pipe—see page 786 of Mr. Schussler's testimony), the weight of the 3176 feet of original 30-inch wrought iron pipe taken up and replaced as above. This original 30-inch pipe, at the average weight of 41.6 pounds per lineal foot of pipe (Test. p. 786), would represent a weight of plate iron of 132,121.6 pounds, or, in round figures, 132,000 pounds.

Adding this weight to the above weight of plate iron in the remaining 65,170 feet of 30-inch pipe of 2,711,000 pounds, we have 2,711,000 pounds plus 132,000 pounds, or a total of 2,843,000 lbs., as the weight of plate iron in the original total length of 68,346 feet of 30-inch wrought iron Pilarcitos pipe line, laid according to the above evidence during the three years from 1867 to 1870 (as shown in Table II).

According to Mr. Reynolds' testimony (see Table II), during the two years of 1868 and 1869, while the main construction work on the Pilarcitos pipe line was going on, there was a separate charge made to "construction account" of $33,864.82 for "salaries."

The proper proportion of this account not being segregated from this general charge, but placed instead to the Pilarcitos pipe account, leaves the inference that, if the segregation had been made the direct cost charges to this latter account would have been increased above the before-mentioned total charge for the work of $388,883.60.

In the absence of any data, as to what such additional charge would be, we will, for the present, accept the latter sum as the cost of the completed original 30-inch Pilarcitos pipe line.

By dividing the above total cost charges for the original Pilarcitos pipe line of $388,883.60 by the total weight of plate iron employed in its construction of 2,843,000 pounds, we have 13 67-100 cents per pound of plate iron as the cost of this entire original 30-inch Pilarcitos pipe line, complete in the ground, which figure apparently includes an insufficient, if any, allowance for incidentals, engineering, etc., expense, and does not include interest during construction.

THE ORIGINAL 30-INCH SAN ANDRES PIPE LINE.

The Cost of This Was Really 12.97 Per Pound of Wrought Iron Pipe.

The original San Andres pipe line, the bulk of which was constructed during 1870 and 1871, as shown in Table II, had a diameter of 30 inches throughout its

entire length from a point near the outlet end of the San Andres tunnel (also known as Bald Hill tunnel) to a point near the College Hill Reservoir in San Francisco.

The southerly portion of the original 30-inch San Andres pipe line was subsequently replaced by a 44-inch and 37-inch pipe, and it is at present (in 1903-04) constituted of the following lengths and diameters of pipe (Test. p. 869):

28,830 feet of 44-inch pipe;
1,400 feet of 37-inch pipe;
39,300 feet of 30-inch pipe;

making a total
length of...69,530 feet for the entire present San Andres pipe line.

The original 30-inch San Andres pipe line was constructed during the seventies (Table II). It was formerly called, in complainant's accounts, "Bald Hill pipe line," as above shown, while portions of the original Pilarcitos pipe line in the same account were called "San Andreas pipe line." It conveyed the water from a screen house, at the outlet of the San Andres tunnel, near point 27 of complainant's exhibit No. 22, and ran thence towards San Francisco by a somewhat straighter and shorter route than now occupied by the present 44-inch and 37-inch San Andres pipe line (the latter new line occupying the stretch located between figures 27 and 29 on complainant's exhibit No. 22).

Regarding the length and location of this original line, since displaced, Mr. Schussler says (Test. p. 2186).

X. Q. 2809: "Mr. Schussler, referring to the San Andres pipe line, about how much of that original pipe line was replaced by the 44-inch and 37-inch?"

A. "About 26,000 feet; that is the record that I have here now. The total length of the present pipe is 69,530 feet. Of that there is left of the old 30-inch pipe about 39,300 feet, which, deducted from the former figure, makes 30,230 feet. This new route of the San Andres pipe line, as I testified before, makes something of a right angle; after leaving the San Andres tunnel outlet it works in an easterly direction towards the County Road, then turns almost at right angles and goes to San Francisco by way of Baden. The old original San Andres pipe line, being 30 inches, runs diagonally from this tunnel outlet to Baden. So that the distance from the San Andres tunnel outlet to Baden Station was about 26,000 feet of the hypothenuse, while the distance that the new line is laid, as described heretofore, of 44 inches and 37 inches, has a total length of 30,230 feet; in other words, the new line, from the San Andres tunnel outlet to the junction at Baden, is about 4,230 feet longer; in other words, the original 30-inch line is about 26,000 feet from the tunnel outlet to Baden, while the new line is 30,230 feet."

X. Q. 2810: "30,230 feet is the length of the pipe that was relaid?"

A. "The length of the pipe that was relaid to take the place of the 26,000 feet, more or less, that was run diagonally through the fields, is 30,230 feet, consisting of 44-inch and of 37-inch pipe."

By adding together the 26,000 feet of original 30-inch pipe (which was since replaced by 44-inch and 37-inch pipe) and the 39,300 feet of original 30-inch pipe which is still in use in the present San Andres pipe line, we have a total length of the original 30-inch San Andres pipe line of 65,300 feet.

On page 869 of Mr. Schussler's testimony, the weight of plate iron in this remaining portion of the original San Andres pipe line is given as follows:

"39,300 feet of 30-inch pipe, averaging 37 1-2 lbs. of plate iron per lineal foot, or .....1,473,750 lbs."

Of the total weight of plate iron used in the 26,000 feet of original 30-inch pipe (which was mostly taken up and entirely replaced by the 30,230 feet of 44-inch and 37-inch pipe, as above shown), Mr. Schussler makes no mention in his estimates of cost of reproduction in 1903-04 of the present San Andres pipe line, as the new 44-inch and 37-inch had taken its place on the remodeled San Andres pipe line prior to the time when this testimony was given.

Mr. Schussler's testimony (p. 2189) regarding the disposition made of a large portion of the original 26,000 feet of 30-inch San Andres pipe, coupled with his estimates of a portion of this pipe used in the Lake Merced drainage system (Test. p. 1259), furnishes the information from which the weight per running foot of this pipe can be obtained.

(Page 2189.) X. Q. 2825: "That pipe line which ran diagonally across the field—has all of that been taken up?"

A. "Not all of it; there is some of that does not pay to take up; it is too deep in the ground and it costs too much."

X. Q. 2826: "What did you do with that which you did take up?"

A. "We have taken that up and piled it up in our pipe yard at Millbrae. We have laid quite a large piece of it—something like half a mile of that pipe—I have the details here. Of the original 30-inch San

Andres pipe there is accounted for, in my inventory of July 1st, 1903, only 1,764 feet of this 30-inch pipe at the Millbrae pipe yard. There is at present, that is, on January 1st, 1905, in the Millbrae pipe yard, 17,445 feet, or nearly ten times as much; that pipe during that time had been taken up and had been cleaned and partly dipped. Besides the 17,445 feet at the Millbrae pipe yard on January 1st, 1905, we have laid in the North Lake Merced protection system 2,637 feet of this pipe, making a total of the pipe used and on hand at present, 20,082 feet, or, in round numbers, about 20,000 feet. The pipe originally was 26,000 feet in length, so that of the 26,000 feet there is accounted for, in my inventory of January 1st, 1905, and in the pipe laid on the Lake Merced Drainage System, about 20,000 feet out of the 26,000 feet. Of the remaining 6,000 feet, a portion of that has been taken up in former years and used for road culverts and other purposes, but I do not know how much; the rest of it has been left in the ground and abandoned because it was either too expensive to take it up or it is not in a sufficiently good condition to warrant its being taken up, particularly that portion of the pipe which was of the very lightest iron, in the upper portion of the line, that is, in the most southerly portion of the line."

For reasons that will hereafter be fully detailed, Mr. Schussler, in his estimates of what it would cost to reproduce the various structures under the conditions ruling in 1903-04, and of the same quality of materials and workmanship employed in the construction of complainant's wrought iron present conduit lines, has established the standard figure of 10.60 cents per pound of plate iron used, as the average cost of pipe complete in the ground; while for wrought iron pipe, laid on trestles (and exclusive of the cost of the tres-

tle), his average standard figure per pound of plate iron is 8.60 cents per pound. Both of these average cost figures are exclusive of an allowance for incidental, contingent, engineering and superintending expenses, and exclusive of interest during construction.

In most cases, in his pipe estimates, the weight of the respective amount of plate iron used is given, as well as the cost per pound, and the total cost. In isolated cases, where, in Mr. Schussler's estimates for wrought iron conduit pipes, it happens that the cost of the pipe is mentioned and not the weight, the latter can be obtained by dividing the cost by the above average standard figure of 10.60 cents or 8.60 cents per pound, respectively.

If, on the other hand, it happens that in the respective testimony the weight is given and not the cost, then the cost of the pipe can be ascertained by multiplying the weight in pounds by the above cost estimate of 10.60 cents or 8.60 cents per pound, respectively.

In estimating the cost of reproduction in 1903-04, for the 2,637 feet of 30-inch pipe taken from the original San Andres pipe line and relaid in the North Lake Merced Drainage System, Mr. Schussler has adopted the above average standard figure for complainant's wrought iron conduit pipes, of 10.6 cents per pound of plate iron in the pipe lines complete in the ground and ready for service, which figure of 10.6 cents and 8.60 cents per pound, respectively, do not include 10 per cent allowance for contingent, engineering and incidental expenses, nor five per cent allowance for interest during construction.

On page 1258 of his testimony, where Mr. Schussler speaks of the 8-inch cast iron sewer pipe, which crosses over two deep gulches (side by side with the 30-inch

wrought iron surface drainage pipe in the North Lake Merced Drainage System), he says:

"This pipe is 730 feet in length on both trestles combined."

Again, on pages 1259 and 1260, where he gives his estimate of cost of reproduction of the above mentioned 2,637 feet of 30-inch wrought iron pipe used in the North Lake Merced Drainage System, he says:

"2,637 feet of 30-inch wrought iron pipe laid complete, with labor, transportation, digging trench, laying part of it on trestles..$12,850"

Of the 2,637 feet of 30-inch pipe, 730 feet are laid on the above two trestles (along side of the 8-inch cast iron sewer pipe), while the remaining 1,907 feet are laid in the ground.

In order to arrive at the total weight of these 2,637 feet of 30-inch pipe we can from the above data first ascertain the average cost per pound of plate iron used.

1,907 feet of pipe at 10.60 cents per pound, and 730 feet of pipe at 8.60 cents per pound, make an average cost per pound for the entire 2,637 feet of 10.04 cents, or, in round figures, of 10 cents per pound.

By dividing this average cost of 10 cents per pound into the total cost (exclusive of trestles) of the entire pipe line complete of $12,850 (Test. p. 1260), we get the total weight of plate iron in these 2,637 feet of 30-inch pipe as 128,500 pounds. By dividing this total weight by the total number of feet of 30-inch pipe laid, or 2,637 feet, we have 48.72 pounds as the average weight of plate iron in each lineal foot of this pipe line.

The pipe recovered from the original San Andres pipe line and either stored or utilized for conduit purposes, comprised the heavier portion of the same. Other portions of pipe were used for road culverts

and other purposes, while the very lightest iron, particularly in the upper or most southerly portion of the line, was abandoned (Test. p. 2189).

The average weight of plate iron per lineal foot of the 39,300 feet of 30-inch pipe, still remaining in use out of the total length of 65,300 feet of original 30-inch San Andres pipe line is 37.50 pounds per lineal foot (Test. p. 869).

Comparing this weight with the weight of 48.72 pounds of the heavier pipe, used in most of the above 26,000 feet of pipe, we find that the average weight per foot of the latter is greater than that of the former.

In the absence of accurate data relating to the weight of small portions of the pipe heretofore utilized for road culvert and other purposes, and of the southerly or lighter portions which were abandoned, it is safe to say that the average weight of plate iron per lineal foot used in the above original 26,000 feet of 30-inch pipe did not exceed the above average weight of the heavier pipe of 48.72 pounds, and that therefore the total weight of plate iron in the entire length of 26,000 feet of original pipe did not exceed 26,000 times 48.72 pounds, or a total weight of 1,266,720 pounds.

Adding to this weight of plate iron for the 26,000 feet of pipe the weight of plate iron in the 39,300 feet of 30-inch pipe still in use, of 1,473,750 pounds (Test. p. 869), we have a total of 2,740,470 pounds, or, in round figures, 2,740,000 pounds, as a fair estimate of the weight of plate iron used in the construction of the entire original 30-inch San Andres pipe line of the length of 65,300 feet.

As shown on Table II, the original San Andres pipe line is charged by complainant's accounting department with direct charges amounting to $355,636.97.

By dividing these total cost charges for the original 30-inch San Andres pipe line by the above weight of plate iron used in its construction, of 2,740,000 pounds, we have 12.97 cents per pound of plate iron as the cost of this entire original 30-inch San Andres pipe line complete in the ground. This figure apparently includes an insufficient, if any allowance for incidental, engineering, etc., expenses, and does not include interest during construction.

THE CRYSTAL SPRINGS 44-INCH PIPE LINE.

The Cost of This Really Exceeds 10.1 Cents Per Pound of Wrought Iron Pipe.

The original Crystal Springs 44-inch pipe line, the direct charges for which appear in complainant's Table III, was laid from the upper Crystal Springs dam, through what is now the lower Crystal Springs reservoir, thence down the San Mateo Canyon, and thereafter via Burlingame, Millbrae, San Bruno, along the bay shore to the University Mound Reservoir in San Francisco.

Subsequently, upon the construction of the main concrete Crystal Springs dam, the upper or southerly portion of this pipe line (within the site of the Crystal Springs Reservoir and the main dam) was taken up, removed and disposed of over various parts of complainant's works.

The total length of the original 44-inch Crystal Springs pipe line was 95,660 feet, being composed of 87,260 feet at present in use as the Crystal Springs main pipe line from the concrete dam to the University Mound Reservoir (Test. p. 981), and 8,400 feet of pipe removed from the site of the Crystal Springs Reservoir and dam (Test. p. 935).

Speaking of the weight of plate iron in the present length (1903-04) of the Crystal Springs 44-inch pipe line, of 87,260 feet, Mr. Schussler's testimony says (pp. 985-6):

"Of this total length of 44-inch, towit, 87,260 feet, we had of No. 6 iron 66,900 feet, weighing, per lineal foot of plate iron, 101 lbs., or a total of .....6,756,900 lbs. 20,360 feet of the 44-inch pipe was of No. 7 iron, weighing 93.25 lbs. per lineal foot of plate iron, or .....1,898,570 lbs. thus making the total weight of plate iron in the 87,260 feet of 44-inch pipe ..8,655,470 lbs. or, in round figures, 8,655,000 lbs."

The 8,400 feet of original Crystal Springs pipe line, after having been taken up and removed from the sites of the Crystal Springs Reservoir and main dam, were subsequently used, distributed and stored as follows:

a. At the inlet or westerly end of the new San Andres 44-inch pipe line (Test. p. 869): "2,020 feet of 44-inch wrought iron pipe, of metal fully 3-16th of an inch thick; we call that full No. 7 Birmingham gauge, weighing per lineal foot of plate iron 96 1-4 lbs., or .....188,365 lbs."

b. The next piece taken from this line was laid in the Pilarcitos conduit line (Test. p. 776). It was 750 feet long, and the plate iron in the same weighed. 75,000 lbs.

c. The third portion was used in the construction of the new Lock's Creek aqueduct, where it forms an inverted syphon across San Andres Valley; its length (Test. p. 1043) being 2,100 feet, and the weight of plate iron in the same being .....203,700 lbs.

d. 1,200 feet of this 44-inch pipe was taken to the main outlet of the north Lake Merced and there laid; 600 feet in the outlet tunnel and 600 feet in a trench from the northerly end of this tunnel (Test. p. 1261). The estimated cost of these 1,200 feet of 44-inch pipe, exclusive of 10 per cent for incidental, engineering, etc., expenses (Test. p. 1261) is $12,340.00. The weight of plate iron in this length of pipe can be ascertained by dividing this sum of $12,340.00 by the standard average cost per pound of plate iron adopted by Mr. Schussler in his estimates of 10.60 cents per lb. This makes the weight of plate iron in this line ..... 116,415 lbs.

e. In the tunnel connecting the southern with the northern branch of Lake Merced, there were used 147 feet of this 44-inch pipe line (see page 1255), costing complete, exclusive of incidentals, etc., $1,510.

To arrive at the weight of plate iron in this pipe, this sum of $1,510 has to be divided by the above average standard estimate of 10.6 cents per lb., which gives the weight of plate iron in this portion of the 44-inch pipe ..... 14,245 lbs.

f. Near Lake Honda Reservoir, under what is known as the Balboa Boulevard, 174 feet of this 44-inch pipe was laid to act as a culvert. The cost of this portion of the pipe so laid in place is estimated on page 1361 of testimony at $1,720. By dividing this sum by the standard average estimate of 10.6 cents per pound of plate iron in this pipe, we have the weight of the same ..... 16,225 lbs.

By adding together the above various lengths of the original 44-inch Crystal Springs pipe line, so distributed over the present works of complainant, and also their respective weights of plate iron, we have the following total length and weight, so distributed:

Length:	Weight:
6,391 feet;	613,950 lbs.

By dividing this total weight by the total length, we have an average weight of plate iron per lineal foot of pipe so distributed of 96.06 pounds, or, in round figures, 96 pounds per lineal foot.

The portion of the original Crystal Springs 44-inch pipe line, taken up from the site of the Crystal Springs Reservoir and dam, having heretofore been shown to be 8,400 feet in length, the remaining length of 2,009 feet (which is obtained by deducting the 6,391 feet, so relaid, from the total of 8,400 feet taken up, is stored at complainant's pipe yards, which latter contained, on January 1st, 1904, 1126 feet of 44-inch pipe in the San Francisco yard, and 3055 feet of 44-inch pipe in the Millbrae yard (Test. p. 1505-6).

This total of 4,181 feet of 44-inch pipe on hand on January 1st, 1904 (besides the above balance left over from the original 8,400 feet of Crystal Springs pipe), includes a portion of the original 44-inch Crystal Springs pipe, which crossed the Islais Creek Valley in San Francisco County and which was taken up after having previously been relaid, with other 44-inch pipe, on a new route and trestles.

The average weight of plate iron per lineal foot of the above 6,391 feet of 44-inch pipe, so relaid in other places, being, in round figures, as above shown, 96 pounds, it is safe to say that the plate iron in the balance of 2,009 feet of this original 8,400 feet of Crystal Springs pipe line, averaged about the same number of

pounds per lineal foot, it having been taken from the same locality where it had been used under the same circumstances and for the same purpose.

2,009 feet of pipe, at 96 pounds per lineal foot, makes a total weight of plate iron of, in round figures, 192,850 pounds.

By adding this weight of plate iron to the above weight in the 6,391 feet of 44-inch pipe, we have:

6,391	feet weighing	613,950 lbs. and
2,009	feet weighing	192,850 lbs.
or 8,400	feet weighing	806,800 lbs.

As above quoted from pages 985-6, the total weight of plate iron in the present 87,260 feet of 44-inch Crystal Springs pipe line was, in round figures:

	8,655,000 lbs.
Adding to this total, the weight of plate iron in the 8,400 feet of pipe so removed and distributed, of	806,800 lbs.
We have a total of	9,461,800 lbs.

representing that total weight of plate iron used in the original 95,660 feet of the original 44-inch Crystal Springs pipe line.

As shown in Table III from Mr. Reynolds' testimony, the total direct charges, made by complainant's accountants from 1883 to 1887 to this construction of the original Crystal Springs pipe line, without including allowance for engineering, incidentals, etc., amount to $1,036,163.43.

For the present we will assume that in this total of $1,036,163.43 complainant's accountants have included the original cost of the trestles, concrete piers and the drifting and bricking of two tunnels on this line.

Counsel for defendants in their brief attempt to show that Mr. Schussler's estimates of the cost of reconstructing these extra structures under the conditions of 1903-04 is greater than their original cost. In the absence of accurate data of the original cost of these extra structures, and in order to arrive at some approximate figure of what the pipe proper did then cost per pound of plate iron, we will here extract from Mr. Schussler's testimony his estimates of cost of these special structures, and then deduct their total from the above total sum charged for the original Crystal Springs pipe line of $1,036,163.43.

The balance so obtained will represent as near as it is possible to ascertain at present the total of direct charges made in accountants' books to the "Crystal Springs pipe line."

This treatment will certainly be fair to the defendants, as it is by no means certain that the cost, or a large portion of the cost of these extra or special structures on this line have not been, at least partly, charged, amongst other matters, to the "New Construction" account.

The following are Mr. Schussler's estimates for 1903-04 of these special structures:

Tunnel from Visitacion Valley into University Mound District (drifted and bricked), (Test. p. 996)	$45,317.00
Short pressure tunnel, drifted and bricked (Test. p. 990)	8,370.00
Concrete pier and trestle bridges (Test. p. 989)	27,168.00
Total	$80,855.00

Therefore, $1,036,163.43, less $80,855.00, or $955,-308.43, would represent the direct charges to the construction of the original 95,660 feet of wrought iron 44-inch Crystal Springs pipe line, as constructed during the period from 1883 to 1887 (Table III), even after having deducted from the total direct charges of $1,036,-163.43 Mr. Schussler's estimate of $80,855.00, which latter defendants' counsel, in their brief, attempt to show to be too high an estimate.

By dividing the above sum of $955,308.43 by the total weight of plate iron used in its original construction, of 9,461,800 pounds, we have 10.096 cents, or, in round figures, 10.10 cents per pound of plate iron used. That figure, based upon the direct charges made by complainant's accountants to the Crystal Springs pipe account, and exclusive of incidental, contingent, engineering, etc., expenses, and of interest during construction, represents, as near as obtainable, the direct charges made to this pipe line per pound of plate iron. As shown in Mr. Schussler's testimony, the plate iron employed in the construction of the entire Crystal Springs 44-inch pipe line was of a superior and high-priced quality. From the above result of average direct cost charges of only 10.10 cents per pound of plate-iron, it appears quite certain that the large, general "New Construction" account (Table III) during the period when this pipe line was in course of construction, contains many items, aside from incidental, contingent, engineering, etc., expenses, which should have been directly charged to this account, thus increasing the above average cost charges of 10.10 cents per pound, to a figure which would be nearer the actual original cost of the same.

Original Alameda 36-Inch Pipe Line.

The Cost of This Is Really 12.87 *Cents per Pound of Wrought Iron Pipe.*

The original 36-inch Alameda pipe line conducted the Alameda Creek water from the neighborhood of Niles, and after running first in a southwesterly and then in a northwesterly direction to and past the Belmont pumping station, connected with the 44-inch Crystal Springs pipe line at Burlingame.

The Bay of San Francisco was crossed by two sixteen-inch ball-jointed submarines pipes, as was also a navigable slough to the east of Dumbarton Point.

The direct charges for the cost of construction of this original pipe line, as shown on Table III, are $1,586,869.30.

For the year 1888 (Table III), the direct charges to the original Belmont Pumping Station, then in course of construction, amounted to only $81,575.11, which amount is far too low, as the original Belmont Pumping Station cost considerably in excess of this sum.

By referring to the Municipal Reports of 1900-1901, there appears in the Secretary's account, rendered to the Supervisors (regarding expenditures of the Spring Valley Water Works) the following charges to the above two accounts, which will assist in arriving at a more correct understanding of the charges made to the original 36-inch Alameda pipe line proper. (See Municipal Report of 1900-1901, page 71, Appendix.)

"Cost of Alameda and Calaveras System.

4. Pipe line begun in September, 1887, and completed in November, 1890. .$1,589,869.30
2. Belmont Pumping Works, begun in March, 1888, and finished in December, 1888 ..... 166,535.22"

This latter account shows for the pipe line an excess of $3,000.00 over that shown in Table III; and, for the Belmont Pumping Station, an excess of $84,960.11 over the total charge of $81,575.11, as shown from Mr. Reynolds' testimony in Table III. It is quite likely, therefore, that this difference (relating to Belmont) of $84,-960.11 between the above-quoted Secretary's account furnished to the Supervisors and Mr. Reynolds' account was, in the latter case, included in "New Construction" or in some other account; while the smaller difference of $3,000.00, between the two accounts of the Alameda pipe line, may also be due to a similar cause or to a misprint.

Neither complainant's Secretary, in his report of 1900-1901 to the Supervisors, nor Mr. Reynolds', as shown in Table III, make any special mention of:

a. The original 16-inch submarine pipes, and their shore connections;
b. Nor of the long trestles, through the marshes on each side of the bay;
c. Nor of the large 36-inch gate, at the junction at Burlingame;
d. Nor of that portion of the work on Niles aqueduct that was constructed after June 30, 1887 (but which does not include the old, original Vallejo's mill rubble stone aqueduct, which was built many decades before, but which was embodied in the present Niles aqueduct estimates, and which old stone aqueduct is referred to in Mr. Schussler's estimates on page 1130, in the words: "40,000 cubic feet of rubble work" constructed in the stone aqueduct.....$18,000)

Although the cost of neither of these four items, a, b, c and d, is specially mentioned as being wholly or partly included in the direct cost figure given by

complainant's Secretary to the Supervisors in 1900-1901, of $1,589,869.30, for the Alameda pipe line, in the absence of reliable information on this subject, and not being in possession of the actual cost of construction, we will deduct from the total as given by Mr. Reynolds and as shown in Table III, of $1,586,869.30, the cost of reproduction for 1903-04, as estimated by Mr. Schussler, although, in defendant's brief, repeated attempts have been made to show that Mr. Schussler's estimates on this work are high. We will thus give defendant the benefit of the result so obtained as the cost charges for plate-iron used in this pipe line.

In order to arrive as near as practicable and possible under the circumstances, at what the original 36-inch Alameda pipe line proper cost (as laid during the latter part of the eighties), based on the above direct total cost charges of complainant's accountant, and also upon the plan above outlined regarding the Niles aqueduct (built at the same time), we will first have to determine the weight of plate iron used in the entire original 36-inch pipe line.

The original 36-inch Alameda pipe line, as laid during the calendar years of 1887 and 1888, was somewhat longer than the present line. At that time the 36-inch pipe extended from the point where it crossed the Southern Pacific Railroad, near Niles, and south of Alameda Creek northwardly across a steel bridge, and to and along the Stockton branch of the Southern Pacific Railroad for a distance of 5,760 feet. Of this distance, 2,188 feet were of heavy No. 7 plate-iron (Test. p. 1138), weighing 76 1-2 pounds per lineal foot of pipe (Test. p. 1164); while the remaining 3,572 feet were of heavy No. 9 iron (Test. p. 1138), the plate-iron in which weighed 65.2 pounds per lineal foot of pipe (Test. p. 1164).

In other words, this portion of the original 36-inch Alameda pipe line, which now (and in Mr. Schussler's estimates for 1903-04) belongs to the Niles aqueduct, contained a total weight of plate iron of 404,630 lbs. (Test. p. 1138), or, in round figures, 404,600 lbs.

The present Alameda 36-inch pipe line, as remodeled since the construction, in the early part of this century, of the Sunol Aqueduct, connects the present Sunol Aqueduct screen-house, near Niles, with the point of its junction with the above mentioned 5,760 feet of 36-inch Niles Aqueduct pipe.

The Sunol Aqueduct (new) portion of the present Alameda 36-inch pipe line, having a length in round figures of 4,775 feet, occupies that portion of the present pipe line shown on profile on complainant's exhibit No. 22, which lies between the westerly end of Sunol screen house, and the southerly or right hand end of "Niles Bridge" on said profile. This pipe is made of heavy No. 7 iron, and, as such, is included in Mr. Schussler's estimate of weight of the entire present 36-inch Alameda pipe line, from the Sunol aqueduct screen-house, near Niles, to its junction with the Crystal Springs pipe, near Burlingame. The weight of plate-iron in this length of pipe of 4,775 feet of No. 7 iron, averages 76.5 pounds per lineal foot of pipe (Test. p. 1164). The total weight of plate-iron, therefore, contained in this length of 4,775 feet of pipe, is, in round figures, 365,300 pounds.

In order to arrive at the total weight of plate-iron employed in the original 36-inch Alameda pipe line, as laid during the years 1887 and 1888, we have to add the difference between the weight of 365,300 pounds of the present Sunol branch of this pipe line and the weight of 404,600 pounds of the above Niles aqueduct branch, to the total weight of plate-iron contained in

the entire present 36-inch Alameda pipe line of 10,028,000 pounds (Test. p. 1164).

The difference between 404,600 pounds and 365,300 pounds is 39,300 pounds, or, in round figures, 39,000 pounds.

10,028,000 pounds, plus 39,000 pounds, gives 10,067,000 pounds, which is the weight of plate-iron contained in the original 36-inch Alameda pipe line, as laid and completed in the latter part of the eighties.

In order to ascertain what portion of the original direct cost charges to "Alameda pipe line," of $1,586,869.30, represents the original 36-inch wrought-iron pipe line of a total length of 144,135 feet, we shall, as above indicated in the following subdivisions: (a. Original 16-inch submarine pipes; b. Trestles through bay marshes; c. 36-inch gate at Burlingame; d. Portion of Niles aqueduct) ascertain as nearly as practicable, the cost charges represented by these four groups of construction which are, no doubt, included in the figure $1,586,869.30 for the Alameda pipe line, furnished to the Supervisors in 1900-1901 at $1,589,869.30 as above shown.

As the Niles aqueduct (subdivision d) requires more detailed treatment than the other subdivisions, a, b and c, we will take that one first.

d. Niles Aqueduct.

Mr. Schussler's estimate of the cost of reproduction, in 1903-04, of that part of Niles aqueduct which was constructed by complainant during the latter part of the eighties, when the construction of the original Alameda pipe line was going on, is here briefly re-

peated from pages 1136 to 1139 of his testimony, as follows:

"Excavation for dam	$ 2,200
Stone masonry dam	9,600
Brick work at intake and forebay at above dam	500
Brick work on Niles aqueduct	16,580
Stone sand-box	3,800
3,200 feet of flume	8,060
Wooden screen tank	1,090
Steel bridge at Niles	10,300
Keeper's cottage	1,700
Upper and lower screen-house and store-house	980
	$54,810"

or, in round figures, $54,800.

It should be noted here that:

1. As previously stated, the estimate of the ancient stone-masonry aqueduct is not included.

2. The 5,760 feet of 36-inch pipe have already been accounted for herein, in ascertaining the total weight of the entire original 36-inch pipe.

3. The 22-inch cast-iron pipe and one 22-inch gate, estimated at $670 (see p. 1138) are not included as they were constructed later than the original pipe, this work having been done at the time of construction of the present Sunol aqueduct.

a. Original 16-Inch Submarine Pipe.

Referring to complainant's testimony, we have:

Original double 16-inch submarine pipe line, with shore connections complete, crossing Bay of San Francisco and navigable slough (Test. p. 1178) $160,000

b. Trestles Through Bay Marshes:

Piled trestle complete, across the marshes, on both sides of the bay, on which trestle the 36-inch Alameda pipe line was laid (Test. p. 1166)	74,000

c. 36-Inch Gate at Burlingame:

Heavy 36-inch gate, at Burlingame junction, complete (Test. p. 1167)	1,600
Add to this, for the above detailed structures on the Niles aqueduct (Subd. d)	54,800
We have a total of	$290,400

The last mentioned sum, as above stated, will be deducted from the total of direct cost charges made by complainant's accounting department to the construction of the original 36-inch Alameda pipe line (see Table III), which line was "begun in September, 1887, and completed in November, 1890" (see page 71 of Appendix to Municipal Reports, 1900-1901). This will determine, as near as practicable, what portion of the latter sum total of the Secretary's direct charges would represent the total cost charges due exclusively to the construction of the original total length of the 36-inch Alameda pipe line.

Therefore $1,586,869.30, less $290,400.00, leaving $1,296,469.30, or, in round figures, $1,296,000.00, represents the direct charges to the construction of the original Alameda pipe line, which total does not include any charge for Niles aqueduct 16-inch submarine pipes, trestles across the bay marshes and 36-inch gate at Burlingame.

On page 1164 of complainant's testimony, the total length of the Alameda 36-inch pipe (as estimated on for 1903-04) is shown as 143,150 feet.

To get the total length of this pipe, as it was laid originally in 1887 and 1888, we have to add thereto the difference in the length between the original Niles aqueduct branch and the present Sunol aqueduct branch of this pipe line, both located east of the Southern Pacific Railroad, near Niles. The former branch, as previously shown, contains 5,760 feet, and the latter branch 4,775 feet, of 36-inch pipe. The difference between these two lengths is 985 feet, which, added to the total length of 143,150 feet of the present Alameda pipe line, gives the total length of the original 36-inch Alameda pipe line as 144,135 feet.

The total weight of plate-iron contained in this length of 144,135 feet of original 36-inch pipe line has been heretofore shown to be 10,067,000 pounds.

The total of the Secretary's direct cost charges of construction of 144,135 feet of the original Alameda 36-inch pipe line has been reduced as above shown to $1,296,000.

To ascertain the average cost of this pipe, complete in the ground and on bridge and trestles and ready for use, we have to divide the latter total cost charges of $1,296,000 by the total weight of 10,067,000 pounds of plate-iron used in the entire original 36-inch pipe line. This gives 12.87 cents as the average cost charge per pound of plate-iron used in the original Alameda 36-inch pipe line.

THE NEW SAN ANDRES PIPE LINE.

The Cost Charge to This Is 8.50 Cents per Pound of Wrought Iron Pipe.

This pipe line as now constituted (as heretofore shown under the head of "the original 30-inch San Andreas pipe line") consists of:

28,830 feet of 44-inch pipe,
1,400 feet of 37-inch pipe, and
39,300 feet of 30-inch pipe.

The plate-iron used in this pipe line for its various sections (Test. p. 869) was as follows:

2,020 feet 44-inch pipe, full No. 7 Birmingham gauge, weighing 93 1-4 lbs. per foot of pipe.....	188,365	pounds
26,810 feet 44-inch pipe, full 1-4 inch thick	3,586,430	pounds
1,400 feet of 37-inch pipe weighing.	145,000	pounds
39,300 feet of 30-inch pipe	1,473,750	pounds
Total weight of plate-iron	5,393,545	pounds

or, in round figures:

5,393,000 pounds.

We shall now proceed to determine the original cost charges, as taken from Mr. Reynolds' testimony and shown in Table III of the first three of the last four items, namely:

2,020 feet of 44-inch pipe weighing 188,365 pounds
26,810 feet of 44-inch pipe weighing 3,586,430 pounds
1,400 feet of 37-inch pipe weighing 145,000 pounds
having a total weight of plate iron of: 3,919,795 pounds
or, in round figures, 3,919,800 pounds contained in the above length of 30,230 feet of wrought iron pipe, which constitutes what is called in Table III "the new San Andres pipe line."

The first-mentioned 2,020 feet of No. 7 44-inch pipe was, as previously shown, taken from that part of the original 44-inch Crystal Springs pipe line, which was taken up and removed from the site of the present main Crystal Springs reservoir and dam; and consequently, in the charge in Table III for this part of the San Andres pipe line only the hauling from Millbrae to the ditch, and the mechanical and common labor necessary to lay and connect this pipe in the ditch, is charged up in this account.

As previously shown, under the head of "Crystal Springs 44-inch pipe line," according to the direct charges made to its construction by complainant's accounting department, this pipe cost, exclusive of incidentals, interest, etc., 10.1 cents per pound of plate iron used for the pipe complete in the ground.

The direct charges made by complainant's accounting department for construction of the above 44-inch and 37-inch pipe portion of the present San Andres pipe line (Table III), amounts to $320,339.79.

Although the cost of the Crystal Springs 44-inch pipe, laid in the ground, according to the direct charges by complainant's accountants, amounts to the low figure of 10.1 cents per pound of plate-iron, we have no data on the subject of what portion of this 10.1 cents per pound would be a fair estimate for the original cost of the Crystal Springs iron, rivets, manufacture into pipe, coating with asphaltum and transporting by rail to Millbrae. In order to be on the safe side, although this high-grade Crystal Springs iron was costly when purchased, we will for the present, for the sake of a safe and conservative estimate, place the value of the pipe manufactured into pipe coated with asphaltum, transported to Millbrae and in every way

ready to be hauled to and laid and connected in the trench, at the low figure of 7 cents per pound of plate iron.

That this estimate of 7 cents a pound of plate-iron for the above pipe, delivered at Millbrae yard and ready to be hauled to the ditch and laid therein, is low, is shown by the fact stated on page 2274 of complainant's testimony that this plate-iron cost in San Francisco 4.6 cents per pound. Deducting this amount from the above estimate of 7 cents a pound, we would only have a balance left of 2.4 cents a pound for manufacturing the pipe into lengths in San Francisco, complete and ready for asphaltum coating ; for the asphaltum coating, inclusive of materials, fuel, labor and power ; for rivets used in manufacturing, and for transporting the pipe to the distributing yard at Millbrae and unloading the same there.

Although all of this work and material (outside of the cost of the bare plate-iron delivered in San Francisco at 4.6 cents per pound, as above shown), cost considerably over 2.4 cents per pound of plate-iron used, still in order to be below rather than above the actual cost figure, the low estimate of 7 cents a pound has here been used though it is not to be construed as representing the actual cost of the 44-inch Crystal Springs pipe, when at that stage.

At seven cents per pound, the 2,020 feet of original Crystal Springs pipe, containing 188,365 pounds of plate iron, would be worth at the Millbrae pipe yard $13,185.55.

By adding the above valuation of $13,185.55 of 2,020 feet of 44-inch original Crystal Springs pipe, delivered at Millbrae yard, to the cost charge, as shown in Table III for the remaining 26,810 feet of 44-inch pipe, and 1,400 feet of 37-inch pipe, amounting to $320,339.79, we

get a total of $333,525.34, representing the direct cost charges for the new San Andres pipe line, the plate-iron in which, as above shown, has a weight of 3,919,800 pounds.

By dividing the above sum of $333,525.34 by the total weight of plate-iron of 3,919,800 pounds we find that the cost charges per pound of plate-iron amount to 8.50 cents per pound.

This low cost charge per pound of plate-iron in the new San Andres pipe line appears from the testimony due to the fact that the plate-iron used in this pipe line was not only of a somewhat lower grade, but also, at that time, of a much cheaper price than the iron used before and after the construction of this line; complainant not being able to obtain the usual higher grade of iron in the time at its disposal, and, at the same time, taking advantage of a depression in the iron market.

The other factor responsible for this low cost charge is the custom (as shown heretofore), of complainant's accountant, of omitting incidental charges, and also frequently charging things into the general "new construction" account, which should have been properly charged or apportioned directly to the cost of the respective structures.

As will be hereafter seen, Mr. Schussler, in making his estimates, in his testimony, for the cost of reproducing the present San Andres pipe line, includes the entire present San Andres pipe line, which, in addition to the 28,830 feet of 44-inch pipe and 1,400 feet of 37-inch pipe also contains 39,300 feet of original 30-inch pipe, making its total length 69,530 feet.

When, hereafter, it may become necessary to compare the actual direct original cost charges of this entire present pipe line with Mr. Schussler's estimate

of cost of reproduction in 1903-04, where he treats the entire present pipe line as a unit, then, in that case, the total of all of the direct cost charges for the entire present San Andres pipe line must be established for the purpose of a proper comparison.

By applying the direct cost charges of 12.97 per pound of plate-iron, as shown in discussing the "Original 30-inch San Andres pipe line" to the plate-iron, contained in the 39,300 feet of original 30-inch San Andres pipe still in use, we get the total proportional direct cost charges for the 1,473,750 pounds of plate-iron contained therein, as $191,145.37.

By adding together the above three totals of:

$320,339.79, being direct cost charges (Table III) to new San Andres pipe line;

$13,185.55, being low estimate of cost of materials, manufacturing, coating and transporting to Millbrae of 2,020 feet of original 44-inch Crystal Springs pipe;

$191,145.37, being proportion of original direct cost charges for 39,300 feet of original 30-inch San Andres pipe line still in use, we have $524,670.71.

Of this total, the sum of $511,485.16, or 97½ per cent, is taken from complainant's direct cost charges (Table III) while $13,185.55, or only 2½ per cent (not being separately charged in complainant's accounts) is arrived at from complainant's testimony, and, as above stated, is below actual cost.

This sum of $524,670.71 or, in round figures, $524,600, represents, as near as it can be established, the direct cost charges to the original construction of the present or new San Andres pipe line, the total weight of plate-iron contained in which, as heretofore detailed from page 869 of complainant's testimony, is 5,393,000 pounds.

By dividing the above total direct cost charges of $524,600 by the total weight of plate-iron in this entire present pipe line, of 5,393,000 pounds, we have an average cost charge for this pipe line, complete in the ground, of 9.72 cents per pound, which latter figure is the direct cost-charge for the entire present San Andres pipe line.

The New 54-inch Alameda Pipe Line

The Cost of This is Really 11.30 *Cents per Pound of Wrought-iron Pipe.*

This pipe line, mostly laid during 1902 and 1903 (Table III), connects the 36-inch original Alameda pipe line at Burlingame with the Millbrae pumping station, as well as with the 44-inch Crystal Springs pipe line near this station.

It has a length of 16,758 feet, and contains 2,976,570 pounds of plate-iron, and also 28,813 pounds of flange iron, used for straps, making a total weight of plate-iron used of 3,005,383 pounds, or, in round figures, 3,005,000 pounds. (Test. p. 1202.)

In regard to the time and circumstances under which this last one of complainant's large pipe lines was constructed, Mr. Schussler testifies as follows (p. 1202):

> "I have stated heretofore that during the construction of the 54-inch pipe—the new Alameda pipe line—we have had some late experience as regards the cost of construction of the pipe line work nowadays with the schedule of wages that is now maintained, and also what is called a day's work at present during the year 1903-04. I have stated that I would go into detail in connection with the construction of this pipe line, and thus establish, by compar-

ing it with some of the other pipe lines, the fact that this pipe, constructed in the extreme thorough manner that we insist upon, constructed of first-class material and of the very best workmanship, with every precaution taken against rust, accident or interruption of supply; I shall give the data which gives me the cost per pound of plate iron used in the construction of these pipes.

The direct cost charges made to the construction of the new 54-inch Alameda pipe line, as shown in Mr. Reynolds' testimony and tabulated in complainant's Table III, amount to $347,201.99.

During the two years of 1902 and 1903, while 97 per cent of the above sum was being expended, according to the above direct charges, in the construction of this pipe line, the charges to the general "new construction" account were over $603,000.

As in the particular case of this 54-inch new Alameda pipe line, complainant's engineering department had an opportunity to ascertain accurately the cost of construction (including materials) of this specific pipe line, including the proper allowance for incidental, contingent, engineering and superintending expenses; and as the total so obtained is in excess of the above total charges by complainant's accountant department of $347,201.99, it appears probable that a portion of the charges that should properly belong to the construction account of this specific pipe line has, amongst other things, found its way into the above general "new construction" account.

Still, as the sum total of direct charges, made by complainant's accountant department, to this pipe line amounts to $347,201.99, we will, for the present, assume that it includes the cost of the systems of connections between the 36-inch and new 54-inch Alameda pipe

lines at Burlingame, and between the 54-inch new Alameda pipe line with the Millbrae pumping plant and with the 44-inch Crystal Springs pipe line.

Mr. Schussler testifies that these connections consisted of iron pipes, fittings and gates, and he estimates them at $7,670. (Test. pp. 1202-03.)

As a large portion of them were taken from the stock on hand in complainant's pipe yards, and had been paid for in previous years, their cost, in all probability, was not again charged to this new 54-inch pipe account.

In the absence, however, of any data on this subject in the testimony of Mr. Reynolds, as tabulated in Table III (and although defendant not only considers this estimate high, and it also includes many pipes and fittings taken from complainant's stock on hand and previously paid for), still, in order to be on the safe side, we will deduct from the above total charges of $347,201.99 the amount of $7,670, estimated by Mr. Schussler for these connections, leaving a balance of $339,531.99. That sum, under the above conditions and according to complainant's accountant's direct charges, would represent the net charges made to the wrought-iron pipe portion of this line and exclusive of the above described connections.

The weight of plate-iron contained in this 54-inch pipe line, as previously shown, is 3,005,000 pounds. By dividing the above total charges of $339,531.99 by the total weight of plate-iron of 3,005,000 pounds, we obtain, as a result, 11.298 cents, or, in round figures, 11.30 cents per pound of plate-iron used in the construction of this pipe line.

The heretofore detailed analysis of cost charges, made by complainant's accounting department, both direct charges made to specific structures and general

charges, made to a general "new construction" account has plainly shown that the sum total of these general "new construction" charges, which appear under the separate heads (as shown in Tables II and III) of "new construction," "general expense," "general construction," "salaries," "instruments engineer's department"—includes an average of at least ten per cent, which should have been added to the direct charges made to the specific structures enumerated in Tables II and III.

The following Table IV gives a brief recapitulation of the names of the original wrought-iron pipe lines, their diameter in inches, their length in feet, the total weight of plate-iron used in each, the total cost charges based upon the direct charges of complainant's accountants and, finally, these direct charges reduced to the pound of plate-iron used in each of the respective original pipe lines.

TABLE IV

Being a recapitulation of the six original wrought iron pipe lines of the Spring Valley Water Company, Complainant.

No.	Name of Pipe Line	Diameter in inches	Length in feet	Weight of plate-iron used	Direct cost charges by complainant's accounting department	Cost charges per pound of plate-iron used
1.	Original Pilarcitos pipe line	30″	68,346	2,843,000	$ 388,883.60	13.67 cts.
2.	Original San Andreas pipe line:	30″	65,300	2,740,000	355,636.97	12.97 cts.
3.	Original Crystal Springs pipe line:	44″	95,660	9,461,800	955,308.43	10.10 cts.
4.	Original Alameda pipe line	36″	144,135	10,067,000	1,296,000.00	12.87 cts.
5.	New San Andreas pipe line:	44″ and 37″	28,830 1,400	3,919,800	333,525.34	8.50 cts.
6.	New Alameda pipe line:	54″	16,758	3,005,000	339,531.99	11.30 cts.
	Total:			32,036,600	$3,668,886.38	11.45 cts. average

In the spring of 1900, Mr. Schussler, answering Mayor Phelan's question as to the cost of wrought-iron pipe, based his cost figure on the data furnished him by complainant's secretary. On this occasion, Mr. Schussler referred to the Islais Creek pipe, which was

the latest pipe for which iron had just been ordered of the same quality as that used in the bulk of the new San Andres pipe line. This iron, although not up to the quality of the high-grade charcoal iron used in nearly all of the other pipe lines of complainant, was still good first-class iron. (Test. p. 2273.) Basing his figures upon the book records of direct charges of complainant's secretary he gave the following approximate estimate:

"It (the pipe) will not come very far from 8½ cents per pound."

He did not include in that estimate any allowance for engineering and incidental expenses.

Table IV, item 5, gives the cost charges to new San Andres pipe line, fully 95 per cent of which is laid underground. The bulk of the new Islais Creek pipe is laid on a trestle and consequently cheaper per pound of plate-iron than if laid underground (Test. pp. 986-989.) The direct cost charges to the new San Andres pipe line of 8.50 cents per pound (Table IV, item 5) appear low, therefore, when compared with the estimate of 8.50 cents per pound for the Islais Creek pipe.

The average direct cost charge of 11.45 cents per pound for all the plate-iron used in the six main pipe lines of complainant (Table IV) is 0.85 cents per pound higher than the corresponding average estimate 10.60 cents per pound in Mr. Schussler's testimony.

To this Mr. Schussler, in his estimate, adds 10 per cent for engineering and incidentals, whereby his total average (exclusive of interest during construction) becomes 11.66 cents per pound.

The average direct cost charges of complainant's accounting department of 11.45 cents per pound shown by Mr. Reynolds' testimony tabulated in Tables II and III, and as shown in Table IV, will, probably, be still

further increased by at least 10 per cent for engineering and incidentals, and by a further addition of a portion, if not all, of the 14.44 per cent contained in the large, general "New Construction," etc., account of complainant's accounting department, as previously shown.

Thus, by the addition of ten per cent to the above 11.45 cents per pound, we have in round figures 12.60 cents per pound as the cost of complainant's pipe lines, while Mr. Schussler's testimony estimates the average cost of reproduction in 1903-04 at 11.66 cents per pound.

VII.

THE COST OF PLATE-IRON.

THE TESTIMONY FULLY JUSTIFIES THE PER-POUND UNIT ADOPTED BY MR. SCHUSSLER IN HIS ESTIMATES OF COST OF REPRODUCTION IN 1903-04, AND THERE IS NO WARRANT FOR THE UNIT ADOPTED BY DEFENDANTS' COUNSEL IN TABLE 7, PAGE 239, OF THEIR BRIEF.

Defendants' counsel in the division of their brief headed "Wrought Iron Pipe" (commencing on page 200) assert in substance that Mr. Schussler, in adopting an average of 10.6 cents per pound for the wrought-iron pipes, complete and laid in the ground, based his average on a grossly excessive estimate of the cost per pound of plate-iron. At page 239 they insert a table (Table No. 7), in which they adopt a unit cost of about 3 cents a pound for plate iron, which unit they contend is established by the testimony. We propose to show that the testimony does not warrant the deductions drawn by defendants' counsel and that on the contrary, Mr. Schussler's estimates are fully and clearly established.

In reference to the cost of iron imported and used by complainant for the various large pipe lines above enumerated in Table IV, Mr. Schussler, after having spoken of the somewhat lower grade of iron that had to be used in the San Andreas 44-inch and 37-inch pipe line, and of the lower cost of this iron when compared with that used in the Crystal Springs and other pipe lines of complainant (the Eastern iron market being much depressed just at that time, see Testimony, pp. 2274 and 2275, and the necessary quantity of high-grade iron used in complainant's other pipe lines not being obtainable in the limited time), testifies regarding the cost per pound of the various lots of iron used at the time of construction of complainant's main pipe lines, and states what the cost (delivered in San Francisco) of the same quality of iron as used in the respective pipe lines would be, in 1903-04, as follows:

X. Q. 3140: "You have made your estimates on all of the pipe everywhere as to first-class pipe, have you not?"

A. "I beg your pardon; I have made an estimate of the pipe of such iron as was in that specific pipe; so that, for instance, the average price of the iron used in the San Andres pipe line is considerably below the price of the iron used in the 54-inch pipe. The iron that we then, in about 1900*, figured at 2.65 cents in the East, is now figured in the East at 3 cents. That is a very low advance; I think it is more than that now, but that is as near as I could get to it. At that time we caught the market at its lowest ebb, and if we waited a month, I do not think we could have got any such figure as 2.65 cents for that lot of iron. The iron that we have imported for

* The iron referred to was purchased for the 44-inch Islais Creek crossing (see Testimony p. 2271).

the 44-inch Crystal Springs pipe is now worth in the East about 3.9 cents a pound. The iron that we used for the 44-inch San Andres pipe is worth about 3* cents a pound. The average iron that we used for the 44-inch San Andres pipe, where we crossed underneath the railroad, is worth in the East now 4¼ cents a pound. Then the iron that we used in the old San Andres 30-inch pipe line, the 39,300 feet which was left in of the old original pipe, that is worth now in the East about 3.9 cents a pound. For that iron we paid at that time between 5 and 6 cents a pound, if I recollect right. It was imported from Scotland. Taking the 3.9 cents per pound now in the East and adding to it ¾ of a cent per pound, for freight out here, it would bring that, delivered here now, to about 4.65 a pound. Then there is another piece of extra iron pipe that I have quoted only at 3 cents a pound. Summing up the entire San Andres pipe line, beginning at the inlet at the San Andres screen-house and going through the various sizes from there, 44 inches in diameter until it finally lands in San Francisco with the original Scotch iron pipe 30 inches in diameter, I have an average price of 4.06 per pound as the cost now, as near as it can be figured out. That is inclusive of the freight from the East to San Francisco. That 4.06 cents I have rounded off to 4 cents a pound and have inserted that in my estimate of the value of the San Andres pipe. The value of the higher grade iron, for instance, the Crystal Springs pipe, is higher. That iron is worth here 4.6 cents per pound. Of that in the Crystal Springs pipe we brought in 8,655,000 pounds at 4.6 cents per pound delivered here now. The 36-inch Alameda pipe, of which we imported 10,028,000 pounds, that averages here now 4.6 cents per pound. The San Andreas pipe that I mentioned

* This refers evidently to the price in the East, being the same as previous quotation of Crystal Springs iron, and subsequent quotations of better iron under railroad for San Andres 44-inch pipe and for 30-inch San Andres pipe, all having prices quoted **in the East.**

just now, from 44-inch down to 30 inches, averages here now, as closely as can be estimated and inclusive of freight, 4 cents per pound, while the 54-inch Alameda pipe, which is the highest grade of iron that we have and which we shall try hereafter only to introduce in all our works, because although a little dearer it is by far the cheapest in the end; of that we have imported 3,005,000 pounds, and that costs us, delivered here, 4.87 cents per pound. It shows the great variation in the price of iron owing partly to the state of the market in the East and partly to the variation in the method of manufacture, as I have tried to detail heretofore."

X. Q. 3141: "All your pipe is specially manufactured, is it not?"

A. "Not all, no, sir. There was some iron that we bought when we had to quickly make a piece of pipe, small pieces; we sometimes buy iron. The main pipes are specially manufactured for us."

X. Q. 3142: "And there is no such pipe in the market at all, is there?"

A. "No, sir. It is very difficult for us to get the rolling mills started on work of this kind. When we want a small order of our Spring Valley standard iron pipe we have great difficulty in getting it, but when we give a big order, then they get ready in their mills to make it."

In reference to a stretch of 44-inch pipe built on a new line, across Islais Creek, in San Francisco County, in 1900, Mr. Schussler testified, on page 2271, as follows:

Mr. Partridge, X. Q. 3135: "In the water rate investigation for the fiscal year 1900-01, to-wit, in the spring of 1900, did you testify as follows: 'Q. How much did you say you paid for iron, and was it a recent purchase?' A. 'Yes, sir, four or five days ago we

bought it at Pennsylvania at rather a low quotation, 2.65 per pound there, and ¾ of a cent for freight per pound, which makes 3.41 cents, delivered here, and adding 10% for handling it'—A. (Int'g) That is a mistake. That should be *10 cents.''

X. Q. 3134: Yes, that should be *10 cents. I will continue reading the quotation, and adding *10 cents for handling it will cost us 3.51 cents in the shop.''

Regarding the cost of the plate-iron, used in the bulk of the new San Andres pipe line, which although good, first-class pipe iron (Test. p. 2273), owing to press of time, was not of as high a grade as the laminated charcoal iron used in complainant's other main pipe lines, and having been purchased in the fall of 1897 (during a period of depression in the Eastern iron market of the same grade of iron for the 44-inch Islais Creek pipe at 2.65 cents a pound) cost complainant at that time only 1¾ cents per pound East.

Adding to this figure the cost of railroad freight to San Francisco of ¾ cents per pound, we have, for the cost of this plate-iron (composing the bulk of the new San Andres pipe line) delivered in San Francisco (and exclusive of handling from the cars into the shop) 2.50 cents per pound of plate-iron.

Referring to the iron used in the above-mentioned 44-inch pipe, crossing Islais Creek (which iron, as shown above, cost in the East, in 1900, 2.65 cents per pound), Mr. Schussler, in his testimony, on page 2272, states:

X. Q. 3136: ''What pipe is that?''

A. ''That is the 44-inch pipe.''

X. Q. 3137: ''Where is it?''

A. ''I think in 1900 that must have been a short piece of pipe that we laid across Islais Creek; but it

* These should evidently read: "0.10 cent."

was the same quality of iron that we used for the 44-inch San Andres pipe and which lower price I have given due consideration in my estimate of the cost and value of the pipe lines."

From this quotation it will be seen that the Islais Creek pipe iron was of the same quality as that used in the ¼-inch portion of the new San Andres pipe line, the iron for which latter line was purchased in the fall of 1897, at 1.75 cents a pound in the East, and that in a little over two years, namely, from the fall of 1897 until the beginning of 1900 (when the Islais Creek iron was purchased), the price of this same grade of iron had advanced with the improvement in the Eastern iron market from 1.75 cents a pound to 2.65 cents a pound early in 1900.

This same grade of iron, as shown on page 2275 of Mr. Schussler's testimony and as hereinbefore quoted in answer to X. Q. 3140, had advanced, by 1903-04, to 3 cents a pound in the East.

The following Table No. V recapitulates the results so obtained from Mr. Schussler's testimony as to the cost per pound of plate-iron delivered in San Francisco for and during the construction of the six main pipe lines shown in Table IV.

TABLE V

BEING RECAPITULATION OF *COST PRICES* PAID PER POUND OF PLATE-IRON *DELIVERED IN SAN FRANCISCO*, DURING THE PERIODS OF CONSTRUCTION OF THE RESPECTIVE *ORIGINAL* PIPE-LINES OF COMPLAINANT AS ENUMERATED

Name of Pipe Line	Weight in pounds of plate-iron used (see Table IV)	Cost per pound of plate-iron delivered in San Francisco	Total cost of plate-iron in San Francisco (in round figures)	Average cost in San Francisco per pound of plate-iron of *all* the pipe-lines
Original Pilarcitos pipe-line	2,843,000	(between 5 and 6 cents a pound,) average 5½ cts.	$ 156,000	
Original San Andreas pipe-line	2,740,000	(average) 5½ cts.	151,000	
Original Crystal Spgs. pipe-line	9,461,800	4.6 cts.	435,000	
Original Alameda pipe-line	10,067,000	4.6 cts.	463,000	
New San Andreas pipe-line	* 3,919,800	*2.65 cts.	104,000	
New Alameda pipe-line	3,005,000	4.87 cts.	146,000	
Total	32,036,600		$ 1,455,000	4.54 cts.

*The *present* new San Andreas pipe-line is composed of the following weights of different grades of plate-iron, each grade having a different *cost per pound delivered in San Francisco*, as follows:

Page 869:	188,365	pounds of original Crystal Springs iron, costing, delivered in San Francisco, 4.60 cents per pound (see page 2274 of complainant's testimony), or .	$ 8,665 00
Page 869:	101,770	pounds of flange-iron, used for straps, costing, delivered in San Francisco, 4.60 cents per pound, or	4,680.00
Page 869:	3,629,660	pounds of pipe-iron (being 3,484,660 lbs. for the 44″ pipe and 145,000 lbs. for the 37″ pipe) at 2.50 cents per pound, or.	90,740.00
Total weight of plate-iron,	3,919,795	pounds, at a total cost of. . . . . or, in round figures, 3,919,800 pounds, at a total cost of $104 000.00; or 2.653 cents per pound, or, in round figures, 2.65 cents per pound.	$104,085.00

In order to compare the actual cost per pound of plate-iron delivered in San Francisco (as shown in Table V) during the respective periods of construction

of the six pipe lines enumerated in the same table with Mr. Schussler's estimates of cost during 1903-04 of the same respective quality of plate-iron, we will quote from his testimony regarding his cost estimates for this iron in 1903-04, which estimates formed one of the important basic elements of his average estimate of cost per pound of plate-iron for the pipe, complete and ready for service, of 10.60 cents per pound, exclusive of engineering and incidentals.

The Pilarcitos and Original San Andres Pipe.

Regarding Mr. Schussler's estimate of cost in 1903-04 of the iron used in the Pilarcitos and original San Andres pipe lines (the iron in both pipe lines being identical as to quality, he says (Test. p. 2275):

> "Then the iron that we used in the old San Andres 30-inch pipe line, the 39,300 feet which was left in of the old original pipe, that is worth now, in the East, about 3.90 cents a pound."

And again, on the same page, referring to the same iron:

> "Taking the 3.90 cents per pound now in the East and adding to it ¾ of a cent per pound, for freight out here, it would bring that, delivered here now, to about 4.65 a pound."*

Referring to the iron used in the 44-inch Crystal Springs pipe line, Mr. Schussler says (p. 2275):

> "The iron that we have imported for the 44-inch Crystal Springs pipe is now worth in the East about 3.90 cents a pound."

And again, when comparing the present cost of the Crystal Springs iron with the average present cost in

* In his estimates for the average cost in 1903-04 of reproducing complainant's five main pipe lines, Mr. Schussler, instead of the above 4.65 cents per pound of plate-iron has used for these two lines the rounded-off figure of 4.60 cents per pound.

the entire present San Andres pipe line, Mr. Schussler says (p. 2276):

> "The value of the higher grade iron, for instance the Crystal Springs pipe, is higher. That iron is worth here 4.60 cents per pound."

Regarding the present cost (in 1903-04) of the iron used in the 36-inch Alameda pipe line, Mr. Schussler says (p. 2276):

> "The 36-inch Alameda pipe, of which we imported 10,028,000 pounds, that averages here now 4.60 per pound."

Referring to the present cost in the East of the iron used in the ¼-inch portion of the 44-inch and 37-inch new San Andres pipe line, to which 0.75 cent must be added for freight to San Francisco, Mr. Schussler says (p. 2275):

> "The iron that we used for the 44-inch San Andres pipe is worth about 3 cents a pound" (*in the East*).

Continuing with the present San Andres pipe line, and referring to the high grade iron used on this line where it crosses underneath the railroad (at Baden), Mr. Schussler says:

"The average iron that we used for the 44-inch San Andreas pipe where we crossed underneath the railroad is worth in the East now 4¼ cents a pound."

Although this iron costs now in the East 1¼ cents per pound more than the iron used in the main ¼-inch portion of the San Andres pipe line, Mr. Schussler has included it in the average present cost figure East of 3 cents per pound, as shown by the following quotation from page 2275:

"Then there is another piece of extra iron pipe that I have quoted only at 3 cents a pound."

In order to arrive at the average present cost delivered in San Francisco of all of the plate-iron contained in the entire present San Andres pipe line, which line, as shown on page 869 of Mr. Schussler's testimony, includes 188,365 pounds of Crystal Springs 44-inch pipe iron, which, as above quoted from page 2275 of the testimony, was there placed by Mr. Schussler at 3.90 cents per pound in the East, we have to add 0.75 cent for freight, which brings it up to 4.65 cents a pound in San Francisco,

The same price of 4.65 cents per pound in San Francisco holds good for the 101,770 pounds of flange iron used for straps and for the 1,473,750 pounds of iron in the 39,300 feet of original 30-inch San Andres pipe line.

We therefore have of iron now costing, delivered in San Francisco, 4.65 cents per pound, the above, 188,365 pounds, plus 101,770 pounds, plus 1,473,750 pounds, or a total of 1,763,885 pounds.

Of the ¼-inch iron, used in the new San Andres 44-inch and 37-inch pipe line, we have (page 869), for the 44-inch pipe, 3,484,660 pounds, and for the 37-inch pipe, 145,000 pounds, or a total of 3,629,660 pounds of iron costing in 1903-04, in San Francisco, 3.75 cents per pound.

By adding together the above respective total weights and total costs, we have:

1,763,885 pounds at 4.65 cents....$82,020.65

3,629,660 pounds at 3.75 cents....136,112.25

making a total of 5,393,545 pounds costing $218,132.90, or in round figures, 5,393,000 pounds now costing in San Francisco $218,100, or an average of 4.044 cents a pound.

Mr. Schussler places the average cost in 1903-04 of all the iron in the present entire San Andres pipe line at 4.06 cents per pound, delivered in San Francisco. (Test. p. 2275). This figure, he states on the same page, he has rounded off to an average of 4 cents a pound, which latter figure he has used in his estimates on the present San Andres pipe line, as one of the basic elements.

The New 54-inch Alameda Pipe.

Regarding the present cost, delivered in San Francisco, of the class of plate-iron used in the construction of the new 54-inch Alameda pipe line, Mr. Schussler says (p. 2276):

> "While the 54-inch Alameda pipe, which is the highest grade of iron that we have and which we shall try hereafter only to introduce into all our works, because, although a little dearer, it is by far the cheapest in the end; of that we have imported 3,005,000 pounds and that costs us delivered here 4.87 cents per pound. It shows the great variation in the price of iron owing partly to the state of the market in the East and partly to the variation in the methods of manufacture, as I have tried to detail heretofore."

The Cost of Plate Iron in Each of the Five Present Main Pipe Lines.

In order to arrive at the total amount represented by the cost delivered in San Francisco of the various lots of plate-iron used in the five present main pipe lines of complainant, we will take from Mr. Schussler's testimony the weights of plate-iron used in each of those pipe lines and by applying to these weights the respective present cost figures of plate-iron delivered

in San Francisco, as above quoted from his testimony, we will arrive at the total present cost of plate-iron for each and all of the five main pipe lines.

Thereafter, by dividing the total cost in San Francisco (for 1903-04) of all the plate-iron in the five pipe lines, by the total weight of the same, we shall arrive at the average cost per pound in San Francisco (in 1903-04) of all of the plate-iron used in the entire five present pipe lines.

The five pipe lines referred to are:

A. Present Pilarcitos pipe line.
B. Present San Andres pipe line.
C. Present Crystal Springs pipe line.
D. Present 36-inch Alameda pipe line.
E. New Alameda 54-inch pipe line.

A. Present Pilarcitos Pipe Line.

(Testimony pp. 785-6.)

"2,400 feet of 22-inch wrought-iron No. 7 heavy pipe weighs, 112,800 pounds.

"The rest of the pipe consists of 65,170 feet of 30-inch wrought-iron pipe, which is somewhat heavier than No. 11 on an average, slightly in excess of 5 pounds to the square foot." "65,170 feet of pipe at 41 6-10 pounds per lineal foot of plate-iron is 2,711,000 pounds."

Making the total plate-iron used in the present Pilarcitos pipe line, 2,823,800 pounds.

2,823,800 pounds at 4.6 cents per pound delivered in San Francisco, represents $129,894.80."

B. Present San Andres Pipe Line.

(Test. p. 869.)

"Total weight of the entire 69,530 feet of pipe, of plate-iron alone, 5,393,545 pounds, or in round figures, 5,393,000 pounds."

5,393,000 pounds, at an average of 4 cents per pound of plate-iron delivered in San Francisco, $215,720.

C. Present Crystal Springs Pipe Line.

(Test. p. 986.)

"Thus making the total weight of plate-iron in the 87,260 feet of 44-inch pipe, 8,655,470 pounds, or, in round figures, 8,655,000 pounds.

"8,655,000 pounds of plate-iron at 4.6 cents per pound delivered in San Francisco, $398,130."

D. Present 36-Inch Alameda Pipe Line.

(Test. p. 1164.)

"Total weight of this pipe 10,028,710 lbs., or, in round figures..... 10,028,000 lbs.

"10,028,000 lbs. of plate-iron at 4.6 cents per pound, delivered in San Francisco $461,288.00

E. New Alameda 54-Inch Pipe Line.

(Test. p. 1202.)

"Making a total weight of 3,005,383 pounds of iron, or, in round figures, 3,005.000 lbs.

"3,005,000 pounds of plate-iron at 4.87 cents per pound delivered in San Francisco ..... $146,343.50"

The following is a recapitulation of the above weights of plate-iron in the present pipe lines, and the respective present cost, delivered in San Francisco:

TABLE VI

BEING RECAPITULATION OF COST PRICES IN 1903–04 PER POUND OF PLATE-IRON DELIVERED IN SAN FRANCISCO OF THE SAME RESPECTIVE QUALITIES AS USED IN THE CONSTRUCTION OF THE PRESENT MAIN PIPE-LINES OF COMPLAINANT

	Name of Pipe Lines	Weight in pounds of plate-iron used	Cost per pound delivered in San Francisco	Total cost in 1903–04 in San Francisco
a	Pilarcitos pipe-line incl. 22″ pipe	2,823,800	4.60 cents	$ 129,894.80
b	San Andreas pipe-line incl. all 44″, 37″ and 30″ pipe	5,393,000	4.00 "	215,720.00
c	Crystal Springs pipe-line	8,655,000	4.60 "	398,130.00
d	36″ Alameda pipe-line	10,028,000	4.60 "	461,288.00
e	54″ New Alameda pipe-line	3,005,000	4.87 "	146,343.50
	Totals	29,904,800 lbs.		$1,351,376.30

Dividing this cost of $1,351,376.30 by the total weight of 29,904,800 pounds of plate-iron, we have: $1,351,376.30 divided by 29,904,800 lbs. equals 4.5169 cents, or, in round figures: 4.52 cents per pound of plate-iron, as the average cost, delivered in San Francisco, in 1903-04, of all the plate-iron used in the five present main pipe lines of complaint.

As shown in Table V, the average cost per pound, delivered in San Francisco, (during their respective periods of construction), of the plate-iron used in the original pipe lines of complainant, totaling a weight of 32,036,600 pounds, was 4.54 cents.

A comparison between this original average cost of 4.54 cents per pound and the average detailed cost estimate of Mr. Schussler of the same respective quality of iron in 1903-04 of 4.52 cents per pound, shows a remarkable coincidence.

Where the cost per pound of plate-iron of the original pipe lines, delivered in San Francisco, varied with quality and the state of the English and Eastern iron market, between a minimum of 2.50 cents, and an average maximum of 5.50 cents per pound, the cost price of the same respective qualities of plate-iron delivered in San Francisco, during 1903-04, also varies with the quality and the state of the Eastern iron market between a minimum of 3.75 cents,* and a maximum of 4.87 cents per pound.

An Examination of the Methods by Which Counsel for Defendant Reach the Results They Endeavor to Show in Their Table No. 7 (Brief p. 239).

Defendants' Counsel, on page 239 of their brief, furnish a table (Table No. 7) which gives a combination of sources from which they claim to have arrived at their remarkable results as to value of plate-iron in San Francisco in 1903-04.

In what follows here, some examples will be given of the methods employed by them in building up the results obtained in this Table, and in its deductions therefrom in which they misinterpret the facts stated in Mr. Schussler's testimony.

* This price of 3.75 cents per pound relates to the ¼-inch iron in the 44-inch and 37-inch portion of the San Andres pipe line, and not to the 3-16-inch portion of the 44-inch pipe, nor to the original 30-inch portion of the San Andres pipe line, which latter two grades of iron cost now, in San Francisco, 4.60 cents per pound, as shown above.

One of the defendants' sources of information appears to be taken from Mr. Schussler's testimony on page 2811, which reads as follows:—

"X. Q. 5169. Have you any contract for the making of the iron for the Crystal Springs pipe line?"

A. "No, sir, I have not. I have this much knowledge, however, that I went on to Philadelphia and made a lot of experiments in Allan Woods' rolling mills as to the rolling of pipe. That was as far back as 1881. I made a lot of experiments in piling the iron and running it out in flat bars and cutting it and piling it again. That was the basis of the contract that was afterwards let for the making of the iron for the 44-inch pipe."

Mr. Schussler does not state in his testimony and it nowhere appears that Allan Woods' rolling mills were the successful bidders when, about four years after the above experiments were made in their shop, the contract for the manufacture of nearly nine and a half million pounds of plate-iron, subject to Mr. Schussler's specifications, was let for this pipe line. The fact is that Allan Wood & Co. did not get the contract. Mr. Schussler's testimony is simply that the experiments made were "the basis of the contract," evidently meaning the basis of what the contract called for.

It is well to bear in mind that this iron, used in the original 44-inch Crystal Springs pipe line, although slightly below the grade of iron used in the 54-inch new Alameda pipe line, is of a grade superior to that used in the 1-4 inch new San Andres pipe line and also to that used in the force-pipe for the Millbrae pumping station, which latter iron was contracted for in December, 1897, at 2.25 cents a pound East.

During the same year of 1897, and preceding only by a few months this latter contract for the Millbrae

force-pipe iron, the contract for the 1-4 inch iron for the new San Andres pipe line, of the same quality of iron had been let for the low figure of 1.75 cents per pound East.

The difference of only a few months between these two quotations shows not only that the San Andres pipe iron had been contracted for during a great depression at the exceptionally low figure of 1.75 cents per pound East, but also that the market, during the short interval between these two contracts (both executed by the same rolling mill) had so revived that, for the second contract, 0.50 cents a pound more, or 2.25 cents per pound, was paid in the East.

Mr. Schussler stated among several quotations of Eastern prices for other grades of iron used by complainant, that the iron in the new San Andres pipe "is worth about 3 cents a pound" (p. 2275), (naturally meaning, in the East, like all the other accompanying quotations). That he was referring to Eastern prices is also shown at the top of the same page 2275, where, in speaking of the iron used in the new San Andres pipe line, he says:

> "The iron that we then, in about 1900, figured at 2.65 cents in the East, is now figured in the East at 3 cents."

Defendants' counsel, on page 212 and in Table No. 7 of its brief, misinterpret this figure of 3 cents a pound, so as to make it appear that this was the cost *delivered in San Francisco.* They would have avoided this error if when citing the isolated passage from page 2275 they had noticed the statement which we have quoted from the top of the same page, referring to the same iron.

On page 2856 of Mr. Schussler's testimony, the present cost price East of this San Andres iron was typewritten as 2.50 cents. This figure of 2.50 cents is undoubtedly an error either of the stenographer or the typist, in view of Mr. Schussler's full testimony on the same subject above quoted. Yet defendants' counsel on page 215 of their brief, use this evidently erroneous figure of 2.50 cents a pound not only for the present cost in the East of the new San Andres pipe iron, but also so as to make it appear that over 23,000,000 pounds of high-grade plate-iron, contained in complainant's present Pilarcitos and remaining portion of the 30-inch original San Andres pipe line, as well as in the 44-inch Crystal Springs and new Alameda pipe lines, which were shown to cost 3.90 cents a pound in the East in 1903-04, would at that time be worth only 2.50 cents a pound in the East.

Defendants' counsel, on pages 206-212 of their brief, discuss the cost of "Plate-iron for San Andres Pipe," and on page 212 they summarize by assigning six reasons for adopting a cost unit of 3 cents a pound for all of complainant's high-grade plate-iron (except that for the new 54-inch Alameda pipe line). Those reasons, while not numbered in defendants' brief, we will classify by the letters A to F inclusive, and will answer them in the same order. They say:

A. "Mr. Schussler's own figure of 3 cents a pound, which he gives as the present value of this pipe in the following statement:

'The iron that we used for the 44-inch San Andres pipe is worth about 3 cents a pound' (p. 2275),

being so near to the cost price, it has been decided to use that unit. For the following reasons it would seem entirely reasonable and jus-

tifiable to use a much lower unit in respect to the 30-inch pipe:

B. 30-inch pipe was made of very thin iron (p. 2628).

C. 30-inch pipe gave a lot of trouble with breaks and leaks (p. 2190).

D. 30-inch pipe had to be replaced (p. 2190).

E. A portion of the 30-inch pipe, so replaced, was at one time considered by Mr. Schussler to be so worthless that he did not contemplate taking it out of the ground (p. 2190).

The 44-inch pipe stated by Mr. Schussler to be more costly than the 30-inch (p. 2191).

F. However, the unit of 3 cents will be found to have been given later in Table No. 7, at page 239."

REPLY TO THE FOREGOING.

A.

As heretofore stated and as will be seen by reading the entire paragraph (on page 2275) relating to the cost of the plate-iron used by complainant, and as also hereinabove fully shown, and just prior to complainant's Table V, and again prior to Table VI, Mr. Schussler's cost estimate for 1903-04, for the 1-4-inch iron used in the new San Andres pipe, was: 3 cents a pound *in the East, to which* 0.75 *cents per pound has to be added for freight to San Francisco,* making this grade of iron cost here 3.75 cents per pound, and not 3 cents per pound, as counsel tries to construe it by quoting only one short sentence out of the paragraph on page 2275 relating to Eastern quotations.

B, C, D and E.

Mr. Schussler, on page 2628 of his testimony, in relation to the old San Andres pipe line, which in 1897-98, when it was replaced by the larger new San Andres

pipe line, had been in active service under heavy pressure for over 26 years, states as follows:

> "The old San Andres pipe line is 30 inches in diameter and is made of very thin iron. The new pipe line is 44 inches in diameter and is made of 1-4 inch iron."

This portion of the original 30-inch San Andres pipe, referred to by defendant, had not been in use by complainant for fully seven years when Mr. Schussler testified in this suit. The iron in the same had cost originally as previously shown by quotations from complainant's testimony, between 5 and 6 cents per pound of plate-iron delivered in San Francisco. It would cost to deliver the same quality of iron in 1903-04, 4.60 cents per pound of plate-iron as previously shown herein—in spite of its being thin iron, when compared with the heavier 1-4-inch iron used in the larger new 44-inch San Andres pipe. It had done excellent service for over twenty years, and then, as shown in Mr. Schussler's testimony (page 2190), the original pipe, owing partly to "salt water" damage to the plates while in transit via Cape Horn, and partly to alkali in the "soil" (Test. p. 2191), it gave signs of weakness, which trouble gradually increased. This portion of the original 30-inch pipe line was replaced about 1897-98 by the heavier and much larger 44-inch new San Andres pipe line, laid on a new route.

F.

The final reason assigned by counsel, as before quoted, for their assumption of the low-cost figure that:

"The 44-inch pipe stated by Mr. Schussler to be much more costly that the 30-inch (p. 2191)," affords no justification for their arbitrary assumption of the low cost unit.

Mr. Schussler testified in regard to the apparent physical condition of a portion of the original 30-inch San Andres pipe line before it had been replaced by the 44-inch new San Andres pipe line, and also as to the condition in which it was found to be after the latter pipe had replaced it. He says (p. 2191):

X. Q. 2830: "Again in 1901, in testifying before the Board of Supervisors, referring to that pipe, did you say 'it would not pay to take it up?' "

A. "That is what my opinion was then, yes. That was a report made to me by our foremen, that they had looked at the pipe in various places and they thought it was better to leave it in. I so reported. Since that time I insisted upon having it investigated and we took up the pipe and found a large portion of it in first-class condition. It was unfit for the purpose for which it was being used at that time because it gave too much trouble."

Referring to Mr. Schussler's opinion expressed to the Supervisors several years prior to his testimony in this suit, that the southerly portion of the original 30-inch San Andres pipe line was practically worthless, he says (p. 2190):

X. Q. 2829: "Have you changed your opinion since?"

A. "Yes, because when we commenced to take out the pipe we found that so much of it was in good condition that we could use for these various purposes nearly four miles of it—20,000 feet out of 26,000 feet. That pipe has given us a good deal of trouble with breaks and leaks, as I stated, and particularly in the ground where there was alkali in the soil. There was another factor that caused us to lay the new pipe and that was that we wanted to increase the capacity. That probably was not

stated in that testimony at that time. That was the reason why we did not relay it by a 30-inch pipe, but, instead of that, a 44-inch pipe, which is much larger and much more costly. We are very much pleased to find upon investigation that so much of that pipe* is still in good condition, but the pipe, as a unit, as a whole, giving us a good deal of trouble, was not a fit pipe to keep because we had a great deal of trouble with it. When we dug it up and took out the good portions of it we found that a large portion of it was useful."

The foregoing quotations from the testimony show clearly that the reasons advanced by counsel for defendants for adopting a low cost unit for plate-iron are wholly untenable.

Reply to Defendants' Reasons for Adopting a Low Cost Unit on Plate-Iron Based on Mr. Grunsky's Testimony.

In order to somewhat fortify their low computed figures on plate-iron, counsel for defendant, on page 215 of their brief, quote from a progress report of the former City Engineer, Mr. Grunsky, in relation to a proposed municipal water supply from the Sierra as follows:

"The main item of cost for all Sierra Nevada projects is that of pipe construction. The best quality of laminated iron has been assumed the requisite and has entered into the calculations at 3.25 cents per pound, San Francisco delivery" (p. 416). Quotations from his Progress Report to Board of Public Works, August, 1901)."

Mr. Grunsky's testimony is again quoted on pages 215 and 216 of defendants' brief, as follows:

*(The original 30-inch pipe)

X. Q. 283: "When you estimated this pipe at 3¼ cents per pound, delivered in California, did you have any bids on the pipe?"

A. "I have information from the Allen Wood Company that iron of the quality which they manufacture could be furnished at 2.50 cents per pound."

X. Q. 284: "There?"

A. "There."

X. Q. 285: "And how much did you allow for freight?"

A. "¾ of a cent."

X. Q. 286: "The Allen Wood iron is what is known as the ordinary commercial iron, is it not?"

A. "But it is iron of high grade. It is an iron that is recognized as of the best."

X. Q. 287: "Is it a homogeneous iron?"

A. "It is manufactured in the ordinary way in which iron is manufactured, but with care in the selection of materials. I have always said that their iron (referring evidently to complainant's pipes) was of unusually good quality. I have made iron the basis of this cost estimate, although at the time I thought it probable that if this work was ever carried out these pipes should be made of steel. Steel is being generally adopted by engineers throughout the country at the present time for such purposes." (pp. 373-4).

An analysis of this testimony of Mr. Grunsky will show the following:

GRUNSKY: (Progress Report, August, 1901):

"The best quality of laminated iron has been assumed the requisite and has entered into the calculations at 3.25 cents per pound, San Francisco delivery."

(For the proposed Sierra Nevada Project in August, 1901.)

SCHUSSLER: (In his testimony, page 2276, 1903-04):

"The 54-inch Alameda pipe, which is the highest grade of iron that we have, costs us, delivered here, 4.87 cents per pound."

Of the next best quality used by complainant to the amount of over 23,000,000 pounds in the Pilarcitos, original 30-inch San Andres, Crystal Springs and 36-inch Alameda pipe lines, Mr. Schussler says (Test. p. 2275):

"That is worth now in the East about 3.90 cents a pound." "Taking the 3.90 cents and adding to it ¾ of a cent per pound for the freight out here, it would bring that, delivered here, to about 4.65 cents a pound."

Regarding the Crystal Springs 44-inch and the Alameda 36-inch pipes, Mr. Schussler says (Test. p. 2276):

"That iron" (for the 44-inch Crystal Springs pipe) "is worth here 4.60 cents per pound."

"The iron for the 36-inch Alameda pipe, that averages here now 4.60 cents per pound."

Although Mr. Grunsky, in the above quotation from his Progress Report (of 1901) calls the lower grade of iron, which he quotes at 3.25 cents a pound in San Francisco, "the best quality of laminated iron," he does not state that it is equal to the quality of the high-grade iron used in the 30-inch Pilarcitos and San Andres pipes and in the 44-inch Crystal Springs and 36-inch Alameda pipe, which, in 1903-04, costs 4.60 cents a pound delivered in San Francisco, while the

still higher grade iron in the 54-inch Alameda pipe costs 4.87 cents a pound in San Francisco.

In other words, while Mr. Grunsky says in effect that he has figured that "the best quality of iron" recommended by him for the proposed Sierra pipes can be laid down in San Francisco at 3.25 cents a pound, he does not say that this iron is as good, durable or expensive as that used in most of complainant's pipe lines, costing, delivered in San Francisco in 1903-04, from 4.60 to 4.87 cents a pound. His testimony, instead of indicating an excessive estimate of cost on Mr. Schussler's part, simply indicates that Mr. Grunsky figured on a lower grade of iron for the Sierra project than that used by complainant in about 88 per cent of the weight of all its pipe lines, with a difference of 1.35 cents a pound in favor of the Pilarcitos and San Andres 30-inch, the 44-inch Crystal Springs and 36-inch Alameda pipes; and of 1.62 cents a pound in favor of the 54-inch Alameda pipe line.

Furthermore, Mr. Grunsky furnished no reliable data for his figure of 3.25 cents a pound. His testimony as to that figure was purely hearsay. There is no evidence that he ever bought or could have bought iron for that price. When Mr. Grunsky was asked in cross-question 283 in connection with his figure of 3.25 cents a pound whether he had "any bids on the pipe" he made no direct reply, but answered: "I have information from the Allen-Wood Company that iron of the quality which they manufacture could be furnished at 2.50 cents per pound" (in the East).

When asked about the grade of iron which he recommends for the Sierra project, he says: "It is of high grade. It is iron that is recognized as the best." He did not say the iron on which he received informa-

tion was of as high a grade as that used in 88 per cent of the weight of complainant's pipe lines.

When asked: "Is it homogeneous iron?" he did not make a direct reply, but said: "It is manufactured in the ordinary way in which iron is manufactured," which answer does not mean anything, but,

Mr. Grunsky does not say that the iron which he thinks he can get laid down in San Francisco for 3.25 cents a pound is as good or of the same high grade as 88 per cent of complainant's iron, but he does say in the next sentence (referring to complainant's pipes), "I have always said that their iron was of unusually good quality."

After quoting from Mr. Grunsky's Progress Report and testimony, counsel, on page 216 of their brief, say:

> "Mr. Grunsky's opinion of the quality of Allen-Wood iron was, it would seem from the following, shared by Mr. Schussler."

As justification for this remark they quote from page 2811 of Mr. Schussler's testimony regarding experiments made by him in Allen-Woods' mill in Philadelphia, in 1881, or 20 years prior to Mr. Grunsky's progress report on the Sierra Nevada project, and about 23 years prior to the date of this investigation, the quotation ending with the statement by Mr. Schussler that those experiments were "the basis of the contract that was afterwards let for the making of the iron for the 44-inch" (Crystal Springs) "pipe."

Mr. Schussler did not say that the Allen-Wood Company got that contract, and the fact is that it did not. But even if it had, that fact would not show or tend to show what quality of iron it was on which the Allen-

Wood Company gave information on prices to Mr. Grunsky twenty years later.

Although it has been distinctly shown from Schussler's testimony that the high grade of iron amounting to 18,683,000 pounds used in the 44-inch Crystal Springs and 36-inch Alameda pipe combined, costs now (1903-04), in the East 3.90 cents a pound, and from 4.60 to 4.65 cents a pound delivered in San Francisco, counsel for defendant take as the basis for their computations Mr. Grunsky's hearsay figure, in 1901, of 3.25 cents a pound for a grade of iron not shown to be the same or of equal value.

Counsel for defendant, on page 217 of their brief, continue by referring to Mr. Schussler's testimony (page 2271), where he speaks of an order placed in the East in 1900 for a lot of iron for the Islais Creek pipe crossing. This iron was obtained on short notice and was of the same grade as that in the new 44-inch San Andres pipe line and not of as high a grade nor as expensive as that used in the 44-inch Crystal Springs and the 36-inch and 54-inch Alameda pipe lines. Mr. Schussler's testimony, in 1900, on this iron, reads as follows:

> "Q. "How much did you say you paid for iron, and was it a recent purchase?"
>
> A. "Yes, sir, four or five days ago we bought it at Pennsylvania at rather a low quotation, 2.65 cents per pound there, and ¾ of a cent for freight per pound, which makes 3.41 cents delivered here, and adding 0.10 cent for handling it"—will cost us 3.51 cents in the shop."

Although this testimony relates to a quality of iron which constitutes only 12 per cent of complainant's main pipe lines (the other 88 per cent being consider-

ably more costly, as previously shown), and although the testimony shows that this San Andres grade of iron now (1903-04) costs in the East 3 cents and in San Francisco 3.75 cents a pound, counsel for defendants conclude this portion of their argument on page 217 of their brief with the statement:

"It is submitted that in using a unit of 3.50 cents per pound of plate-iron on both the Crystal Springs 44-inch and the Alameda 36-inch pipe, full justice will be done and a fair and equitable figure used.

"This unit of 3.50 cents will be found inserted in table No. 7."

Regarding Mr. Schussler's testimony of the cost in San Francisco of the iron used in the 54-inch new Alameda pipe line of 4.87 cents a pound, counsel for defendants, on page 217 of their brief, have not attempted to show that it is worth less than the figure given in Mr. Schussler's testimony, and they therefore do not place a lower figure for this iron in their table No. 7.

In their Tables Nos. 7 and 35 and in the discussion preceding and following, the counsel for defendants have mixed up the various figures on cost of plate-iron with other matters, such as making, laying and transporting the pipe, etc., in such a manner as to be confusing and misleading.

In order to clear up the situation, so as to clearly show what the iron used by complainant did cost originally; what its cost would be in 1903-04, and what defendant wishes to construe the evidence as to what such latter cost should be in 1903-04, a brief recapitulation of all matters here above shown, relating to plate-iron alone is placed in the following table VII.

Our Table VII shows in its first part, in columns A to D, from Mr. Schussler's testimony, as shown in Table VI,

A. The names of complainant's five main pipe lines;

B. The weight in pounds of plate-iron of the various grades contained in them;

C. The cost per pound in San Francisco in 1903-04; and,

D. The total cost estimate of plate-iron used in each pipe line.

The second part of our Table VII, in columns E to J (taken from Table No. 7 of defendants' brief) shows:

E. The weight of plate-iron in four of complainant's five main pipe lines;

F. Defendants' figures, obtained by its own methods, of cost per pound in San Francisco of the various grades of pipe used;

G. Defendants' figure, so obtained, of total cost;

H. The high unit price for all grades of iron, which price defendants arbitrarily assume (although contrary to Mr. Schussler's testimony), resulting in an abnormally high total cost figure, far in excess of Mr. Schussler's testimony:

I. The false total cost, so obtained by defendants;

J. The apparent discrepancies obtained by defendants, by deducting its largely underestimated totals of column G from its false and excessive totals of column I.

The third part of our Table VII (columns K to M) gives in column K Mr. Schussler's testimony as to cost figures for 1903-04; in column L defendants' computed totals; and in column M defendants' deficit below Mr. Schussler's testimony shown in column K:

TABLE VII

A	B	C	D	E	F	G	H	I	J	K	L	M
FROM MR. SCHUSSLER'S TESTIMONY; COMPLAINANT'S TABLE VI				FROM DEFENDANT'S BRIEF, TABLE No. 7						COMPLAINANT'S COMPARISON between Mr. Schussler's cost figures for 1903-04, according to his testimony, for plate-iron used, and defendant's figures, obtained by its own methods of *computation*.		
Name of present pipe-line	Weight of plate-iron in present pipe-lines in pounds	Present Cost in San Francisco (in 1903-04) of respective grade of plate-iron: Per pound	Total	Weight of plate-iron in pounds	"Unit per pound arrived at in previous pages of this brief and from figures on cost."*	"Total computation" *	"Mr. Schussler's unit on basis of Alameda 54-inch pipe" (pp. 1203-6). ***	"Mr. Schussler's estimate, worked out on this unit and inclusive of 10 per cent." †	Differences between "Mr. Schussler's estimate and computation." ††	Mr. Schussler's present cost in San Francisco in 1903-04. (See Col. D).	Defendant's total *computations* from its Table No. 7. (See Col. G).	Deficit of defendant's *computed figures* for the plate-iron used in these four pipe lines of complainant *below the cost figures* for 1903-04 given in Mr. Schussler's testimony.
Pilarcitos pipe-line	2,823,000	4.60 cents	$129,894.80	2,823,800	3.00 cents	$84,714.00	4.87 cents	$151,271.00	$66,557.00	$129,894.80	$ 84,714.00	$ 45,180.80
San Andreas pipe-line	5,393,000	4.00 cents	215,720.00	5,393,000	3.00 cents	161,790.00	4.87 cents	288,903.00	127,113.00	215,720.00	161,790.00	53,930.00
Crystal Springs pipe-line	8,655,000	4.60 cents	398,130.00	8,655,470	3.50 cents	302,941.00	4.87 cents	463,673.00	160,732.00	398,130.00	302,941.00	95,189.00
36-inch Alameda pipe line	10,028,000	4.60 cents	461,288.00	10,028,000	3.50 cents	350,980.00	4.87 cents	537,200.00	186,220.00	461,288.00	350,980.00	110,308.00
54-inch new Alameda pipe line	3,005,000	4.87 cents	146,343.50	**	**	**	**	**	**			
						Total $900,425.00		Total $1,441,047.00	Total $540,622.00	Total $1,205,032.80	Total $900,425.00	Total $304,607.80

*Figures *computed* by defendant

**Omitted by defendant from its table No. 7; although it does not attempt to show in its brief that it could lay down in San Francisco this grade of iron for less than 4.87 cents a pound

*** These figures *not* having been used by Mr. Schussler in any part of these four pipe-lines the caption, "Mr. Schussler's unit," is misleading

†These totals are *not* Mr. Schussler's estimates, but result from *defendant*, falsely assuming the figure of 4.87 cents per pound, multiplying this with the respective weights, and to the result so obtained adding 10 per cent, instead of giving the *correct* respective figures as shown in Col. C.

††Defendant arrives at these *differences* by deducting *its* falsely assumed cost figures (Col. F) for plate-iron, of 3 cents and 3.50 cents per pound respectively, *without* adding thereto 10 per cent for contingencies from *its* falsely assumed figures of 4.87 cents per pound but *with* 10 per cent added thereto for contingencies — although Mr. Schussler has distinctly testified to *his* cost figures See Col. C).

RECAPITULATION

of final results as shown in this table.

Defendant, by its own methods of computation, has misconstrued Mr. Schussler's testimony as to the cost in 1903-04, in San Francisco, of the plate iron in complainant's above four pipe-lines, so as to make it appear that *his* total equals the sum of

$1,441,047.00 (see Col. I)

while, according to Mr. Schussler's testimony, his total for these lots of plate iron is:

$1,205,032.80 (see Col. K)

Thus, defendant's computed total for the same quantity, grade, place and time, of:

$900,425.00 (See Col. L)

shows that defendant's cost figure of $1,441,047.00 (see Col. I) which it tries to impute to Mr. Schussler, is *higher* by

$230,014.20

than Mr. Schussler's own total of $1,205,032.80 (Col. K), while, at the same time, defendant's estimate obtained by its own methods of *computation* of $900,425.00 is:

$304,607.80 *below*

Mr. Schussler's own total cost figure of:

$1,205,032.80

VIII.

Cost of Manufacturing and Laying the Pipe.

Facts Shown by the Testimony Compared with the Computations Made by Defendants' Counsel.

Before looking into the computations of defendants' counsel regarding the cost estimates on manufacturing and laying of the various pipe lines, it is in place here to state that counsel have inserted in their Table No. 35 (Brief p. 450) the values exhibited in their Table No. 7 (Brief p. 239).

In their Table No. 35 they show the comparative results of their mixed computation regarding the plate-iron, making and laying combined, for the Alameda 36-inch and the San Andres pipe lines. This mixed method of computation, if not intended is certainly apt to mislead. The question of making and laying of the pipe will be dealt with here separately, and we will show to what extent the cost of mechanical work of manufacturing and laying enters into Mr. Schussler's sworn estimates of average cost.

The evidence shows that complainant customarily had the plate-iron and rivets manufactured according to its own specifications. The plate-iron for the first two pipe lines (the original 30-inch Pilarcitos and San Andres), was made in Scotland, and for the later pipe lines in the East. The manufactured material was transported to this coast, where a contract was let with a machine or pipe shop to manufacture the plate-iron and rivets into pipes of convenient length. Before shipping these lengths of pipe to the proposed line they were coated outside and in with a heavy coat of asphaltum. In nearly all cases complainant coated the pipes by day's work outside of the manufacturing

contract. In a few minor instances, for short lengths of pipes, the pipe manufacturer also dipped the pipe in asphaltum; but this relates to only a small percentage.

Complainant (with one exception) transported the lengths of pipes, so manufactured and coated, to central distributing points on the proposed pipe line and from these distributed them by teams along the line. The bridges and trestles were built by complainant. The trestles and joint-holes were, in most cases, excavated by complainant. In the case of the 36-inch Alameda pipe line the pipe manufacturer, besides transporting the pipe, also undertook the digging of trench and joint-holes, as well as refilling the same.

The pipe, after having been riveted together in the trench or on the trestles, was then thoroughly repainted by complainant with asphaltum, in and outside, especially at the joints and abrasions. The refilling the trench and the ramming under, to the side and on top of the pipe of the excavated material, then followed.

The pipe contractor, at the proper places designated by complainant, connected all fittings and connections with the pipe by first-class boiler work, as extra work, and where crooked parts of the pipe required straps or elbows he put in the same as extra work.

The contract for the mechanical work on the pipe was generally let for a stated price per running foot of completed straight pipe, for manufacturing in the shop and connecting the same together on the pipe line.

Owing to variation in the diameter of pipe, thickness of metal and weight per foot of the different pipe lines and also to the variation in the cost of materials and labor and changes in circumstances and conditions

under which the many pipe lines were constructed, Mr. Schussler's cost estimates in this suit were reduced to an average cost in cents per pound of plate-iron, in order to arrive at the estimate of cost of reconstruction, in 1903-04, of the present pipe lines.

If the pipe was arranged for lead joints, then the contractor generally bid only on making the lengths in his shop at so much a linear foot, and complainant laid the lead-jointed pipe in its own trench, or on its trestles, at its own expense outside of the contract.

An isolated case of a low bid, made to complainant in 1900, for a small lot of pipe, by a firm outside of San Francisco, is quoted by defendants' counsel on page 249 of their brief.

Although the figures there quoted are for making the pipe and do not include the cost of laying and connecting in complainant's trench, counsel for defendant introduce the contract (taken from defendants' minutes) by saying: "We * * call attention to the low price for the making and laying of the 36-inch pipe," thus conveying the impression that the prices quoted are for both making and laying instead of being only for pipe manufactured and delivered F. O. B. San Francisco. Further investigation would have shown that the laying and connecting of these pipes and the fittings, manholes, etc., in complainant's trench were separately paid for.

In connection with these low figures of 1900 counsel do not call attention to the fact that when, two years later, in 1902, the large contract was let for the new 54-inch Alameda pipe line, involving over three million pounds of plate-iron, the cost of labor having meanwhile materially increased, complainant had to pay a price per pound for the mechanical work on this large

order, which showed a considerable advance over the lower price paid for the small order of 1900.

At the final completion of each of the large contracts for the mechanical work of manufacturing and laying of pipe—all of the extra work done by the contractor, outside of straight pipe work, such as above enumerated, was settled for in the final settlement between the two parties.

Mr. Schussler's testimony gives an account of two such final settlements, concerning the two most recent pipe lines constructed by complainant—being the new 54-inch Alameda pipe line and the new San Andres pipe line.

Regarding the former pipe line, Mr. Schussler says (Test. p. 2666):

A. "This is the 54-inch."

X. Q. 4605: "The Alameda new 54-inch pipe line?"

A. "Yes, sir. That contract calls for various things that have to be done in connection with the pipe. In the first place, we paid a certain amount for the making and laying per pound. That is the main straight long pipe."

X. Q. 4606: "What price is that?"

A. "That price for the straight work is 2.93 cents per pound for making and laying. Then we paid them for the elbow work and all the strap-work; not only elbows, but wherever the pipe changes a little in course we have what they call strap-work. You probably remember seeing the photographs. That is extra work. I will come to that in a minute. For each 8-inch air-valve and with gate and with one 1-inch brass nipple tap, $60; for each 8-inch blow-off, with gate, $55; for each strap-joint, complete and attached, $52; that means wherever the

pipe makes the slightest bend. I will have the photograph book brought here and I can explain it to you."

X. Q. 4607: "Let us not take up the time with that."

A. "Very well. Each 16-inch manhole—they were 16 by 12, but we changed them afterwards to 16-inch circular instead of oval, because they made better work, $25; all the fittings and the extra work, and then all the elbows that we made for all the bridges; the sum and substance of it is that when all the bills were paid for the manufacturing and laying we paid to them, in round figures, $102,000 for this job; manufacturing and laying—that includes all of the bends, all the elbows, all the extra work they did, all the fittings, air-valves, manholes, etc. Dividing the total amount paid to the contractor by the total weight of the pipe laid—not of the pipe laid, but of the iron—we only figure by the plate that has been manufactured into the pipe—we have 3.39 cents per pound. That is what that work costs us. The contract for the plain, straight work, is 2.93 cents, with all the extras, when the whole thing is settled up, it costs us 3.39 cents per pound."

This shows that over and above the original contract price of 2.93 cents a pound complainant, on the final settlement had to pay the contractor an additional price for the extra work equal to 0.46 cents per pound of plate-iron.

The testimony above quoted regarding the 54-inch new Alameda pipe line is of interest, not only because it details the necessary extra work and the extra cost paid to the contractor for it, but because it deals with the only large piece of pipe work constructed by complainant in 1902-03 at the time when the present length

of day's work and the present scale of wages prevailed. Mr. Schussler points this out in his testimony, page 1163, as follows:

> "I have stated heretofore that during the construction of the 54-inch pipe—the new Alameda pipe line—we have had some late experience as regards the cost of construction of the pipe-line work nowadays with the schedule of wages that is now maintained, and also what is called a day's work at present during the year 1903-04."

The second pipe line above referred to, the new San Andres pipe line, of which the amount paid for extra work is also known and given in Mr. Schussler's testimony (p. 2667), was constructed about 1897-99, at a time when, as heretofore shown, the Eastern iron market was much depressed and the price per day for labor on this coast was lower and the labor day longer than at the time of construction of the new 54-inch Alameda line in 1902-03 (the cost of common labor in 1897-99 being 20 cents per hour, while in 1902-03 it was 31¼ cents per hour, or an advance of 50 per cent).

Regarding the extra work on this new San Andres pipe line, Mr. Schussler says (Test. p. 2667):

> X. Q. 4609: "Have you the 44-inch San Andres?"
>
> A. "The price to be paid for the above 27,000 feet, more or less of pipe to be at the rate of $3.12 per lineal foot. That is for the straight pipe, or $84,240. That is just to make the straight pipe. For the elbows and all the extra fittings, of course, there was additional work done. I do not know exactly now what the final settlement was. I have not got that there."
>
> X. Q. 4610: "Does it not give it there?"
>
> A. "It shows various payments made. I do not know whether this is the final situation, but this

shows where the contract calls for straight pipe for $84,240, this shows $99,400 for the total price. That no doubt includes all the fittings, etc. In that San Andreas pipe I think we got the making of the pipe a little cheaper than the 54-inch pipe per pound, but the pipe going through the fields and the trenching being very much heavier, the labor of digging the trench and laying the pipe and refilling the top was considerably more per pound."

Regarding the weight of plate-iron in a lineal foot of this 44-inch new San Andres pipe line, Mr. Schussler says, pp. 2668-9:

X. Q. 4613: "How much does a foot of that 44-inch San Andreas pipe weigh?"

A. "About 130 pounds to the running foot. The 44-inch San Andreas pipe of quarter-inch iron weighs in round figures 130 pounds to the running foot."

On page 869 Mr. Schussler gives the total weight of plate-iron in the ¼-inch portion of the new San Andres pipe line (including 101,770 pounds of flange iron used for straps) as 3,586,430 pounds.

By dividing the above total contract price for straight pipe of $84,240 by the gross weight of plate-iron used, we have 2.34 cents per pound as the original contract price for straight pipe, without extras; while by dividing the total payment made upon the final settlement with the contractor, of $99,400, by the same gross weight of plate-iron of 3,586,430 pounds, we have 2.77 cents per pound, making an increase equal to 0.43 cents a pound for the extra work.

It is clearly shown, therefore, that the extra work over and above the contract on the new 54-inch Alameda pipe line amounted to 0.46 cents a pound, and on the new 44-inch San Andreas pipe line 0.43 cents per

pound over and above the contract cost of mechanical work for straight pipe of plate-iron.

Although the cost of extra work on those lines is shown in detail the cost of extra work on the Alameda 36-inch and the Crystal Springs 44-inch pipes was not brought out.

Counsel at various points in their brief quote from the "minute books" of complainant's directors, and also, in the same brief, give figures extracted by defendants' own expert accountant from complainant's books.

A careful examination by defendants of complainant's minute books and account book in connection with the testimony would have brought out the fact that the contract for the 36-inch Alameda pipe line, as originally approved by complainant's directors at a meeting held on July 20, 1887, must have been modified before the complete execution of the work.

Regarding the 36-inch Alameda pipe contract, defendants' counsel, on page 225 of their brief, state the same as follows:

"Alameda, 36-inch $2,482. (No. 7 iron) page 132.
$2,066. (No. 9 iron) minutes 1887-9"

On page 248 of that brief they quote from complainant's minute book D that the contract was authorized for the Alameda 36-inch wrought-iron pipe as follows:

> "110,700 feet No. 9 iron at 2.066 per foot, plus 28,700 feet No. 7 iron at 2.482 per foot, amounting to $300,000."

The testimony, however, shows that the 36-inch Alameda pipe line, as actually constructed and paid for by complainant, contained a much larger proportion of the heavier No. 7 iron and a much smaller proportion of the lighter No. 9 iron than the quantities

stated in the minutes quoted. (Test. p. 1164.) The original pipe line, constructed in 1887-9, received its water from the Niles aqueduct, and was somewhat longer than the present pipe line, which receives its water supply through the Sunol aqueduct. As heretofore shown, the original 36-inch Alameda line as actually constructed, from the Niles aqueduct, via Dumbarton Point and Belmont, to the 44-inch Crystal Springs pipe at Burlingame, had a total length of 144,135 feet; while the present 36-inch Alameda line has a total length of 143,151 feet (p. 1164), showing that the pipe was originally 985 feet longer than what is now called the present 36-inch Alameda pipe line.

Where the present line consists of 82,345 feet of No. 9 iron, and 60,805 feet of No. 7 iron, the originally constructed line, as hereinbefore shown, consisted of 85,917 feet of No. 9 iron and 58,218 feet of No. 7 iron.

Therefore, while the contract quoted from the minutes called for

> "110,700 feet No. 9 iron at $2.066 per foot, plus 28,700 feet No. 7 iron at $2.482 per foot, amounting to $300,000."

the contract, as actually executed and paid for, was as follows:

85,917 feet No. 9 iron at $2.066 per foot—$177,504.52
58,218 feet No. 7 iron at $2.482 per foot— 144,497.07

Total $322,001.59

or, in round figures, $322,000, instead of the $300,000, quoted from the company's minutes.

The above illustrates the fact the minutes as to contracts made are not a safe guide by which to estab-

lish the total cost of the entire work, after the final settlement with the contractor has been made.

As shown on Table V hereof, the total weight of plate-iron used in the original 36-inch Alameda pipe line was 10,067,000 pounds. Dividing the above $322,000 by the total weight of plate-iron of 10,067,000 pounds we have 3.198 cents, or, in round figures, 3.20 cents per pound of plate-iron paid for the mechanical work of manufacturing and laying of straight pipe.

This price does not include any payment for fittings, such as manholes, air-valves, blow-offs—nor for any extra work performed by the contractor in the shop or on the line, such as patching, straps, elbows, or other work (see p. 1204, testimony). For such extra work as previously shown the contractor for the 54-inch Alameda pipe line received for all of the extra work performed by him, an extra payment over and above the agreed price for straight pipe of 0.46 cent a pound, while the extra mechanical work paid for on the new San Andres pipe line amounted to 0.43 cent per pound.

Regarding the contract for the mechanical work of manufacturing and laying the original 44-inch Crystal Springs pipe line, counsel for defendant, on page 225 of their brief, again quote from the minutes of complainant's directors:

Per lineal foot

"Crystal Springs, 44-inch.....$3.09 No. 7 iron
.....$3.32 No. 6 iron"

Counsel (apparently not being familiar with the length of the 44-inch Crystal Springs pipe line, as originally contracted for, and constructed), do not

give, in their brief, the separate respective lengths of the two different thicknesses of plate-iron used.

As previously shown, the original 44-inch Crystal Springs pipe line, for which the above contract price for mechanical work per foot of straight pipe (and without fittings and extra work) was agreed upon, had a total length of 95,660 feet. The present length of this pipe, as previously shown and as shown on pages 985-6 of Mr. Schussler's testimony, has a total length of 87,260 feet, consisting of:

20,360 feet No. 7 at 93.25 lbs. = 1,898,570 lbs.
66,900 feet No. 6 at 101 lbs. = 6,756,900 lbs.

Total .....8,655,470 lbs.

or, in round figures, 8,655,000 pounds.

The remaining 8,400 feet of the original contract length, as previously shown had a total weight of 806,800 pounds. Total, 9,461,800 pounds, which represents the weight of plate-iron in the entire original 44-inch Crystal Springs pipe line, as originally contracted for.

The respective lengths of No. 6 and No. 7 iron pipe, comprised in the above 8,400 feet of original pipe line (since removed and disposed of otherwise as shown) are not given in the testimony. But the fact that the average weight of plate iron per lineal foot of this length of pipe was a trifle over 96 pounds, enables us to determine very closely how many lineal feet of No. 7 and of No. 6 iron composed the total length of 8,400 feet, as the No. 7 pipe weighs 93.25 lbs. and the No. 6 pipe weighs 101 lbs. per lineal foot. This gives, in round figures, for the 8,400 feet of pipe 5,400 feet of No. 7 iron pipe, and 3,000 feet of No. 6 iron pipe.

By adding these lengths of pipe to the respective

lengths of the same thickness of iron comprised, as above, in the present pipe line, we have: 20,360 feet plus 5,400 feet of No. 7, or 25,760 feet of No. 7 iron pipe; and 66,900 feet plus 3,000 feet of No. 6, or 69,900 feet of No. 6 iron pipe, which gives, as near as practicable, the composition of the original 44-inch Crystal Springs pipe line, of a total length of 95,660 feet, containing a total weight of plate iron of 9,461,800 pounds.

The cost of the mechanical work on this is therefore

25,760 feet No. 7 iron at $3.09	=	$ 79,598.40
69,900 feet No. 6 iron at $3.32	=	$232,068.00
Total: 95,660 feet		$311,666.40

This gives a cost of 3.293 cents, or, in round figures: 3.29 cents per pound of plate iron used in the original Crystal Springs 44-inch pipe line, paid for the mechanical work of manufacturing and laying of straight pipe. This price does not include any payment for fittings, such as man-holes, air-valves, blow-offs, nor for any extra work performed by the contractor in the shop or on the line, such as patching, straps, elbows, or other work.

The following Table VIII gives a brief recapitulation of the above results, showing that the average cost to complainant for the mechanical work of making and laying straight pipe, for the four above main pipe lines, and without any extra work whatever, amounted to 3,085 cents per pound of plate-iron.

TABLE VIII

Name	Total weight of plate-iron in pounds	Original cost of mechanical work of making and laying straight pipe		Total final cost of mechanical work, including all extra work		Cost for extra work in excess of original contract	When built
		Total	Per pound	Total	Per pound	Per pound	
54-inch new Alameda pipe-line	3,005,000	$88,000	2.93 cents	$102,000	3.39 cents	0.46 cents	1902–1904
44-inch new San Andreas pipe-line	3,586,430	84,240	2.34 cents	99,490	2.77 cents	0.43 cents	1897–1899
Original 36-inch Alameda pipe-line	10,067,000	322,000	3.20 cents	Not given in Mr. Schussler's testimony nor in defendant's brief.		Not given	1887–1889
Original 44-inch Crystal Springs pipe-line	9,461,800	311,660	3.29 cents	" "	" "	" "	1884–1886
Total	26,120,000	$805,900	*Average* 3.085 cents per pound				

It must be borne in mind that the three pipe lines last named in the foregoing table, representing 88.5 per cent of the entire weight of plate-iron in all the four lines, were constructed prior to the general shortening of the day's work, which occurred in the early part of this century, at about the same time with a large increase in the day's pay, thus making the cost of labor performed per hour very much greater in (1903-04) than at the time when these three pipe lines were constructed.

The mechanical work of manufacturing and laying the above three older pipe lines having, under the former conditions of much lower cost of labor, averaged 3.085 cents per pound, exclusive of any and all extra work. Coupling this fact with the fact that on the two last-constructed pipe lines (the new Alameda and the new San Andres lines) the extra work performed by the contractor (as shown in Table VIII) amounted to 0.46 cents and 0.43 cents per pound respectively, it is fair to estimate that the actual average present cost figure for the straight mechanical work, including the extra work, equals, if not exceeds, the actual final cost figure for this class of work on the 54-inch new Alameda pipe line, which, on page 1204 of complainant's testimony and on Table VIII of this brief, is given as 3.39 cents per pound of plate-iron.

The last pipe line (the new 54-inch Alameda) was built in 1902-04, at a time when the present (1903-04) conditions existed as to the cost of hourly performance of both mechanical and common labor. It was built in a very accessible place, and in a comparatively straight line. It therefore gives a fair and reliable basis for estimating the cost of reconstruction in 1903-04 of all complainant's pipe lines, particularly as most of the other lines of complainant cross over more uneven

ground, whereby the cost per pound of the mechanical work of connecting the pipes in the trench is increased over that of a straighter pipe.

IX.

The Cost of Rivets.

Facts Shown by the Testimony Compared With the Computations Made by Defendants' Counsel.

The next item in the cost of a wrought-iron riveted pipe line is represented by the rivets used in making the riveted seams of the pipe.

Counsel for defendants, on page 223 of their brief, say:

"Mr. Schussler gives the cost of the iron for rivets at 7 1-2 cents per pound (p. 2287)."

They omit to state that this figure refers to the cost of rivets used in 1884-5 in the construction of the original Crystal Springs pipe line; and that Mr. Schussler, in his estimates, as shown in connection with the 54-inch new Alameda pipe line (Test. p. 1204), gives the rivets, delivered in San Francisco, at $83.33 a ton, or 4 1-6 cents a pound, instead of 7 1-2 cents a pound, as might be inferred from the above statement in defendants' brief.

In Mr. Schussler's testimony on the actual cost of the new 54-inch Alameda pipe line, per pound of plate-iron used in its construction, he says (p. 1204):

"Cost of rivets delivered to the shop in San Francisco: 60 tons of rivets delivered to the shop in San Francisco, in round figures $5,000

$5,000 divided by 3,005,000 pounds of plate-iron .....0.17 cts."

This quotation from the testimony shows the proportion of weight of the rivets to the plate-iron; the present cost, delivered in San Francisco, of the quality of rivets used in complainant's pipe lines, and the cost of the rivets reduced to the pound of plate-iron used in the new Alameda pipe line.

Sixty tons, or 120,000 pounds of rivets, divided by the total weight of plate-iron, of 3,005,000 pounds, equals 0.0399, or, in round figures, 0.04, showing that the weight of rivets used in this pipe line represented about 4 per cent of the entire weight of plate-iron used, which relation between the weight of the rivets and the weight of the plate-iron has been the average relation in complainant's main wrought-iron pipe lines, and has therefore entered into Mr. Schussler's estimate of average cost of reproduction in 1903-04, at the above average cost of rivets of 0.17 cents per pound of plate-iron used in complainant's pipe lines.

X.

Cost of Dipping the Pipe.

Facts Shown by the Testimony Compared With the Computations Made by Defendants' Counsel.

Referring to the asphaltum coating (called dipping), given to complainant's pipe lines, counsel for defendants, on page 229 of their brief, quote from pages 2700 and 2703 of Mr. Schussler's testimony the detailed cost figures given by him of the cost of "dipping" the new 54-inch Alameda pipe line as follows:

ITEMS	COST	PAGE
Building shed and trestle in yard over kettle to keep rain, etc., off, and to assist in hoisting.....	$ 325.00	2703
181 tons of asphaltum, at $15 per ton...	2,715.00	2703
276 bbls. of coal tar, at $4.20 per barrel	1,160.00	2700, 2703
Firewood, 103 cords.....	1,190.00	2703
Repairing of kettle and extra time.....	116.00	2700
*Use of trough and machinery, 17,105 feet at 12½ cents per lineal foot.....	2,138.00	2703
	$ 7,644.00	
Labor—men employed in dipping and handling the pipe and putting it on the cars at the shop.....	$ 4,695.00	2703
	$12,339.00	2703
Rounded off at:	$12,300.00	1205

*Including power to hoist.

Continuing, they say:

"Mr. Schussler divided this total by the number of pounds in the Alameda 54-inch pipe line and arrived at a unit of 41-100 cent per pound. A moment's consideration, however, would show that dipping should be calculated superficially, not by the weight."

Mr. Schussler's testimony, following his above quoted cost account of the asphaltum coating of the 54-inch Alameda pipe line, is as follows (Test p. 2700):

X. Q. 4649: "Does not a thinner pipe take just as much asphaltum?"

A. "Yes, sir, that costs more per lb.* on that account. I stated before that the thinner pipe takes a heavier coat.** When you divide that coat by the lighter weight of the thinner pipe you get a bigger price."

X. Q. 4650: "In making your estimate of dipping on all the pipe lines did you use the same amount for the cost of dipping?"

A. "Yes, sir, for the reason that I have not any data in connection with the Pilarcitos 30-inch pipe, nor the 30-inch San Andres pipe. That cost us a great deal more in those days. In the first place, asphaltum was dearer. Labor was somewhat cheaper then; I do not know what we paid for the coal tar; the coating that we put on a thin pipe has a greater weight in proportion to the weight of the pipe. For argument's sake, if you take a 44-inch pipe, which is made of iron midway between one-quarter and 5-16 of an inch, we will say that weighs a certain number of pounds to the running foot; we will assume that that weighs 180 lbs. to the running foot. That receives a certain weight of asphaltum coating in and outside of the pipe; if that same 54-inch pipe is made of metal half as thick, the coating of asphaltum in and outside is generally fully as thick as it is for the heavier pipe. If, therefore, you divide half the weight of the pipe into the full weight of asphaltum you get a much more expensive coat per lb of iron."

On page 229 of their brief counsel for defendants say:

"A moment's consideration, however, would show that dipping should be calculated superficially, not by weight."

* Of plate-iron.

** Proportionately.

A simple calculation will show that the method advocated would result in largely increasing the cost estimate for the asphaltum coating, over Mr. Schussler's estimated average cost figure of 0.41 cent per pound of plate-iron used.

It must be borne in mind that Mr. Schussler, in determining the above figure of 0.41 cent per pound of plate-iron, used as his basis the actual cost of coating with asphaltum the new 54-inch Alameda pipe line, which is made of much heavier iron than used in all the other pipe lines of complainant; and, furthermore, that he using as a basis for his estimate on all the pipes the cost per pound of the heavy iron in the 54-inch pipe he does not take into consideration the additional cost per pound (due to extra handling and loss of time during the process of dipping) of a much larger number of running feet of smaller and lighter pipe, in order to equal the weight of the 54-inch pipe.

The measurement of the outside circumference of the small course of the pipe, which is equal to the inside circumference of the large course of the pipe, gives the average circumference of both the inside and the outside circumference of any pipe (measurements being taken on the iron before dipping).

In the absence of these specific measurements in complainant's testimony, a simple calculation, based upon the respective clear diameter of the pipe, coupled with the respective thickness of iron, gives very closely the following respective circumferences in feet, which represent in the same number of square feet the average surface on one side of the pipe—per lineal foot of pipe. By multiplying such respective areas by 2 we obtain the total area, both in and outside of the pipe, that has to be coated with asphaltum coating for each

lineal foot of pipe of the diameters named. The result is shown in the following Table IX:

TABLE IX

Name of Pipe-line	Thickness of plate-iron	Average circumference of pipe	Total superficial area per lineal foot of pipe, of inside and outside combined (rounded off)
New 54-inch Alameda	275/1000 inch	14.25 feet	28.5 sq. ft.
New 44-inch San Andreas	¼ inch	11.68 feet	23.3 sq. ft.
44-inch Crystal Springs	—No. 6— —No. 7—	11.65 feet	23.3 sq. ft.
36-inch Alameda	—No. 7— —No. 9—	9.40 feet	18.8 sq. ft.
30-inch Pilarcitos	Average No. 11 full	7.8 feet	15.6 sq. ft.

By taking from the respective pages of Mr. Schussler's testimony the total lengths of the pipes of different diameters, and multiplying such total lengths by the respective total surface area (per lineal foot) for each size of pipe (as above shown), we obtain the

total surface area of the inside and outside of the pipe combined, for the entire length of each of the above lines. The result is given in the following Table X:

TABLE X

Name of Pipe-line	Total surface area covered with asphaltum, per lineal foot of pipe. (See Table IX)	Length of present pipe in feet	Total area covered with asphaltum coating, for each pipe-line (in round figures)
New 54-inch Alameda	28.5 sq. ft.	16,758 feet (p. 1202)	477,000 sq. ft.
New 44-inch San Andreas	23.3 sq. ft.	26,810 feet (p. 869)	624,000 sq. ft.
44-inch Crystal Springs	23.3 sq. ft.	87,260 feet (p. 986)	2,033,000 sq. ft.
36-inch Alameda	18.8 sq. ft.	143,150 feet (p. 1164)	2,691,000 sq. ft.
30-inch Pilarcitos	15.6 sq. ft.	65,170 feet (pp. 785–6)	1,016,000 sq. ft.

The total cost, exclusive of incidentals, of coating the entire new 54-inch Alameda pipe, was $12,339.00, which was rounded off to $12,300.00 (Test. p. 2700).

In order to ascertain what was the cost of coating with asphaltum of each square foot of surface of this pipe line, we divide the above sum of $12,300 by the total surface area in square feet, of this pipe line, as given in Table X, of 477,000 square feet;

$$\frac{\$12{,}300}{477{,}000 \text{ sq. ft.}} \text{ equals } 2.578 \text{ cents per square foot of surface covered.}$$

In order to ascertain what the cost of dipping the pipes would be, based on defendants' plan of calculating the cost by the superficial area instead of by weight, we will assume that all the other pipes of complainant could be dipped at the same low price, as the 54-inch pipe, of 2.578 cents per square foot surface area.

By applying this rate per square foot to the respective total surface areas of the different pipe lines, as given in Table X, we would obtain as the cost of asphaltum coating for each line the result shown in the following Table XI:

TABLE XI

Name of Pipe-line	Total area covered with Asphaltum coating, for each pipe-line (in round figures) square feet	Rate per square foot of surface covered	Cost of asphaltum coating for each pipe-line, if based on *superficial area* (exclusive of incidentals, etc.)
New 54-inch Alameda	477,000	2.578 cents	$12,339.00 (p. 2700) actual cost exclusive of incidentals, etc.
New 44-inch San Andreas	624,000	2.578 cents	16,086.72
44-inch Crystal Springs	2,033,000	2.578 cents	52,410.74
36-inch Alameda	2,691,000	2.578 cents	69,373.98
30-inch Pilarcitos	1,016,000	2.578 cents	26,192.48
Cost of coating above pipe-lines, if calculated superficially, as advocated by defendant. . . . . (p. 229 of its brief)			$176,402.92

As heretofore shown, the actual cost (exclusive of incidentals, etc.) of covering the 54-inch new Alameda pipe with asphaltum coating was $12,339.00 (rounded off to $12,300) for the entire pipe. The weight of plate-iron in this was 3,005,000 pounds, thus representing a cost of 0.41 cents per pound of plate-iron used.

By applying this rate per pound of plate-iron to the total weight of plate-iron in each respective pipe line,

we obtain Mr. Schussler's estimated cost per pound for dipping all the pipe lines, which estimated cost has entered into his total estimates in this suit for the reproduction of all the wrought iron pipe lines, although he shows that the cost per pound of dipping the lighter pipes was really greater than the cost for the heavier 54-inch pipe.

The resulting cost of dipping each of the pipe lines is shown in the following Table XII:

TABLE XII

Name of Pipe Line	Weight of plate-iron in present pipe-lines, pounds.	Cost of asphaltum coating *per pound of plate-iron*, as adopted by Mr. Schussler in his estimates.	Cost of asphaltum coating for each pipe-line, based on *weight of plate-iron* as used by Mr. Schussler (exclusive of incidentals, etc.)
New 54-inch Alameda	3,005,000 (p. 1202)	0.41 cents	$12,339.00 (p. 2700) (actual cost exclusive of incidentals, etc.)
New 44-inch San Andreas	3,586,430 (p. 869)	0.41 cents	$14,704.36
44-inch Crystal Springs	8,655,000 (p. 986)	0.41 cents	$35,485.50
36-inch Alameda	10,028,000 (p. 1104)	0.41 cents	$41,114.80
30-inch Pilarcitos	2,711,000 (p. 786)	0.41 cents	11,115.10
Total weight in pounds of plate-iron	27,985,430 pounds	Total for the above pipe-lines according to Mr. Schussler's estimate	$114,758.76

By placing the cost results last given, based upon the weight of plate-iron (as used by Mr. Schussler), side by side with the results on Table XI, based upon the superficial area plan advocated by defendants, we find that the latter method gives a greater cost for the separate pipe lines and a much greater total cost for the asphaltum coating of all the pipe lines, than obtained by Mr. Schussler's method of basing his estimates upon the pound of plate-iron used. This is shown in the following Table XIII:

TABLE XIII

Name of Pipe-line	Cost of asphaltum coating for each pipe-line if based on *superficial area*, as advocated by defendant (exclusive of incidentals, etc.)	Cost of asphaltum coating for each pipe-line, *based on the weight of plate-iron*, as used by Mr. Schussler (exclusive of incidentals, etc.)	*Excess of cost* of asphaltum coating, if calculated superficially over Mr. Schussler's estimate, based upon the *weight of plate-iron used.*
New 54-inch Alameda	$12,339.00	$12,339.00	.....
New 44-inch San Andreas	$16,086.72	$14,704.36	$1,382.36
44-inch Crystal Springs	$52,410.74	$35,485.50	$16,925.24
36-inch Alameda	$69,373.98	$41,114.80	$28,259.18
30-inch Pilarcitos	$26,192.48	$11,115.10	$15,077.38
Total	$176,402.92	$114,758.76	$61,644.16

By dividing the total weight of plate-iron contained in these pipe lines, of 27,985,430 pounds (Table XII), into the total cost, $176,402.92 (Table XI), obtained by adopting superficial area as a basis, we get a cost of 0.63 of a cent per pound of plate-iron, which exceeds Mr. Schussler's estimate of 0.41 cent by 0.22 cent per pound, or 53 per cent.

Mr. Carey's Testimony as to Dipping Pipe.

The Facts Show That His Testimony Is Unreliable, and, Even if True, Defendants' Computations from It Are Untenable.

Counsel for defendants, in their brief (pp. 229 et seq.), rely for information as to the dipping or asphaltum coating of the pipes on the testimony of Mr. J. Carey.

The following is taken from Mr. Carey's testimony as to his present occupation, and as to the capacity in which he was employed by complainant (Defts.' test., pp. 42-44):

Q. 3. "What is your occupation?"

A. "Teamster."

Q. 6. "Did you ever do any work for the Spring Valley Works or for the Spring Valley Water Company?"

A. "Yes, sir; I have done a great deal of it. From about May, 1862, until the year 1872 or 1873. I worked under Mr. W. H. Lawrence, superintendent, at first. I did driving for the company, and then later hauling of sand, bricks and cement. I drove a mule team six years, but before that I was doing most everything."

* * * * *

Q. 23. "Were you ever engaged in dipping pipe for the Water Company?"

A. "Yes, sir."

Q. 24. "Will you describe in detail whatever work you did?"

A. "I was about one year and a half dipping pipe for the San Andreas pipe line and other pipes for other lines. I had eight men and a boy employed in dipping pipe. I dipped at the old Risdon Iron Works, at the corner of Main and Folsom Streets. I dipped it as fast as they could make it, but they could not make it fast enough for me. We worked ten hours a day, and sometimes I could work them at night time. Two men got $2.50 per day and the rest for $2.00 a day. I received $3.50 per day, and the boy got not more than a dollar a day."

Q. 25. "How many feet of the San Andreas pipe could you dip in a day?"

A. "20 lengths of 20 feet each in a day. I used a dipping trough 22 feet long horizontal. I dipped it into only one trough. The trough was big enough for only one pipe. I put in half a barrel of gas tar to a kettle full of asphalt. I used about two kettles of dip per day. It had to be cooked in the night time. I had four men cooking working nights, and four men and a boy helping me dip in the daytime. I think I did this dipping in about 1880. I hauled the original Lake Merced force main from the Risdon Iron Works, which was then at the corner of Howard and Spear Streets, out to Lake Merced."

From this testimony of Mr. Carey it appears that he worked about ten years for complainant, from 1862 to 1872 or 1873; for the first four years "doing most everything," and for the last six years driving a mule team; that at first he "worked under Mr. W. H. Lawrence, superintendent"; that he hauled "the original Lake Merced main (pipe) from the Risdon Iron Works, Howard and Spear streets, out to Lake Merced; that he was at one time (about 1880) employed for "about a year and a half dipping pipe for the San Andres pipe line and other pipes for other lines"; that of the San

Andres pipe he could dip "20 lengths of 20 feet each in a day"; that he dipped the pipe into only one trough; that the daily wages of the men employed in the dipping were $3.50 for himself, $2.50 for each of two men, $2.00 for each of six men, and about $1.00 a day for a boy; that ten hours constituted the day's work, and he sometimes would work the men at night; that he put half a barrel of coal tar to a kettle** of asphalt; that he used about two kettles of "dip" per day, and had it cooked at night; and that he had four men cooking, working nights, and four men and a boy helping him dip in the daytime.

The last six-year period, during which Mr. Carey says he worked for complainant driving a mule team, includes the two periods during which the 30-inch Pilarcitos pipe line and the San Andres 30-inch pipe line were constructed; the former (Table II) during the years 1867-8-9, and the latter (same table) during the years 1870-71.

As the work of coating these two long 30-inch pipe lines with asphaltum was carried on during the entire respective periods of their manufacture by complainant's "own expert men" (compt's. test., p. 2696); and as Mr. Carey, during this time, drove a mule team for complainant, he could not very well, at the same time, have been dipping the San Andres pipe line. He says, however, that he dipped this line at a later period (in 1880).

The San Andres pipe line was manufactured, dipped and laid in the ground during the years 1870 and 1871 (Table II). Therefore, by the time Mr. Carey began, as he says, to dip the San Andres pipe, about the year 1880, that pipe line had been complete

** A kettle is a large half round iron pot in which coating is cooked and refined and from which it is then filled into the dipping trough.

and in full operation for about nine years. It is very difficult to reconcile his testimony with the facts.

From his testimony, his work as a teamster seems to have come to a close about the year 1872 or 1873. He reappears again as teamster when he hauls the original force pipe from the Risdon Iron Works in San Francisco to Lake Merced (in the southwesterly portion of San Francisco County). This must have been about 1877. The original Lake Merced force-pipe was constructed at the same time with the original Lake Merced pumping station, during the year 1877 (see page 1713 and pages 1753-4 of complainant's testimony).

It appears, therefore, that, during this year 1877, Mr. Carey, while employed as a teamster hauling the Lake Merced force-pipe from the dipping trough at the Risdon Iron Works, in San Francisco, to Lake Merced, came for the first time in his career in contact with the operation of coating complainant's pipe with asphaltum, as a teamster.

Another period of two or three years then intervenes until, about 1880, when for the period of about one and a half years, he claims he was dipping the San Andres pipe and other lines.

When Mr. Carey says: "I dipped it as fast as they could make it, but they could not make it fast enough for me. We worked ten hours a day, and sometimes I could work them at night time"; and that he could dip "twenty lengths of twenty feet each in a day," and that about the year 1880 he "was about one year and a half dipping pipe for the San Andres pipe line and other pipes for other lines," his testimony naturally conveys the impression that he was in charge of the work of coating practically the entire San Andres pipe line during this continuous period of about a year and

a half, as well as other pipe lines constructed by complainant at that time.

By referring to complainant's Table II, which records from Mr. Reynolds' testimony the periods of construction by complainant, and the amounts of direct charges made by complainant's accounting department to such constructions, it will be found that, during the period of one and a half years (about 1880), during which Mr. Carey claims he dipped the San Andres pipe and other pipe lines, there was no new wrought-iron pipe line being constructed, nor does any record appear in Table II of any pipe line having been constructed between the years from June 1st, 1878, to June 30th, 1882.

In other words, for a period of fully four years, during the middle of which, or thereabouts, Mr. Carey claims to have spent about one and one-half years in dipping the San Andres and other pipe lines for complainant, Mr. Reynolds' testimony, based upon complainant's books of record, shows that no pipe line whatsoever was being constructed by complainant.

Mr. Schussler, in speaking of the 30-inch original San Andres pipe line, says (Test. p. 2191):

> "That pipe has given us a good deal of trouble with breaks and leaks, as I stated, and particularly in the ground where there was alkali in the soil."

It is, therefore, probable that Mr. Carey, while testifying about having dipped "pipe for the San Andres pipe line and other pipes for other lines," about the year 1880 and for a period of about one and one-half years, referred to small odd jobs of pipe for the San Andres and other lines, which were needed and used for repair purposes.

This probability is still more strengthened by Mr. Carey's statement that he could dip of this pipe "twenty lengths of 20 feet each in a day."

That this short length of 20 feet per pipe is not the customary length used in the original construction of complainant's pipe lines is shown in Mr. Schussler's testimony, where (speaking of the 30-inch pipes, like the Pilarcitos and San Andres lines) he says (Test. p. 2698):

> X. Q. 4641: "Taking first a 30-inch pipe, a length is how much—11 or 12 feet?"
>
> A. "No, sir, the length runs from about 26 to 30 feet, or thereabouts."

And again, on the same page, Mr. Schussler testifies:

> "If I remember right, we had plates 3 feet wide from Scotland. We tried to get them 42 inches wide, but could not. I believe the plates are not much over 3 feet wide. An even number of plates would in this case be about 10; 10 plates rivetted together would be about 30 feet, less 9 round seams; 9 round seams would amount to a little more than a foot, so that the net length of a 30-inch pipe made out of plates 3 feet wide, 8 feet long—that is about the length of a sheet of 30-inch pipe, allowing for the lap—would be in the neighborhood of between 28 and 29 feet in length. That is what we call a length."

The twenty feet lengths of pipe, which Mr. Carey claims to have dipped about 1880 for the San Andres and other pipe lines were therefore in all probability made and dipped for repair purposes on the San Andres and other pipe lines, as the quantity of pipe made for such repair purposes would be very small when compared with the length of the entire 30-inch pipe lines. And as repair work has been charged by com-

plainant's accounting department to operating expenses, and not to construction, the fact that the pipe, claimed to be dipped by Mr. Carey about 1880 does not appear in Mr. Reynolds' testimony on construction, indicates that if the work were done at all, it was done for repair purposes.

This disposes of the impression that might be created from Mr. Carey's testimony that he dipped the entire San Andres and other pipe lines.

Furthermore, Mr. Carey does not say in his testimony that he did dip 400 linear feet of San Andres (30-inch) pipe. He simply says that he could do it; that if they could have made it fast enough he could have dipped 400 feet of 30-inch San Andres pipe in a day of ten hours, by having a night gang of men cooking and preparing the asphaltum for the next day's dip.

Mr. Carey had to have his full force, including himself, eight men and a boy, on hand and pay them, so as to be ready and able to handle the pipe during the process of dipping, whenever the manufacturer "made the pipe fast enough." The wages for the ten-hour day, as Mr. Carey says, amounting to $21.50 a day, had therefore to be paid anyhow, whether he dipped 200, 300 or 400 feet in a day. Therefore, as Mr. Carey says that they could not make the pipe fast enough for him, he evidently did not dip 400 feet of pipe a day, and therefore the small amount of coal tar and asphaltum which he says he used in a day cannot be applied to 400 feet of pipe, which he says he could have dipped, but which he does not say he did dip.

If Mr. Carey dipped pipe for complainant, about the year 1880, there is no doubt that the same proportion of mixture of coal tar and asphaltum, as well as the method of refining the same, was adhered to, as had

been established as standard and maintained by complainant for many years prior to 1880 and has been used ever since.

This is plainly expressed by Mr. Schussler's testimony, when he says (p. 2704):

> X. Q. 4665: "Are you familiar with what is known as the Sabine process?"
>
> A. "No, sir. There are different methods of dipping pipe, but we have proved that this method we are using is found to give the pipe the longest life and we have adhered to it."

The mixture for dipping the new 54-inch Alameda pipe required 181 tons of asphalt (crude) and 276 barrels of coal tar (Test. p. 2703).

As shown in Table XII, this 54-inch pipe contained 3,005,000 pounds of plate-iron, and, as shown in Table XI, the superficial area of this pipe, covered with refined asphaltum coating, was 477,000 square feet, while the 400 linear feet of 30-inch San Andres pipe, which Mr. Carey says he could have dipped in a day of ten hours if the pipe had been manufactured fast enough, contained, per linear foot of plate-iron, an average weight (Table IV) of

$$\frac{2{,}740{,}000 \text{ lbs.}}{65{,}300 \text{ ft.}} \text{ equals } 41.96 \text{ lbs.}$$

or, in round figures, 42 pounds. This makes the total average weight of plate-iron in 400 feet of 30-inch pipe 400 x 42, or 16,800 pounds; and the superficial area of 400 feet of pipe to be covered with refined asphaltum coating at 15.6 square feet per lineal foot of pipe (Table X) amounted to 400 x 15.6 equals 6,240 square feet.

A.

By adopting the weight of plate-iron basis, used by Mr. Schussler in his testimony, and reducing the above data derived from work actually done on the 54-inch Alameda pipe to the unit established during the dipping of this pipe, we obtain the following results as to dipping materials needed for the 400 feet of 30-inch San Andres pipe:

Experience With 54-Inch Alameda Pipe (Complainant's Test., p. 2703).

ASPHALTUM.

1. 181 tons at 2,000 lbs. equals 362,000 lbs. crude asphaltum; weight of plate-iron in pipe, 3,005,000 lbs. (Table XII).

362,000 lbs. asphaltum divided by 3,005,000 lbs. of plate-iron equals 0.1204 pounds, or, in round figures, 0.12 pounds of crude asphaltum used per pound of plate-iron.

400 feet of 30-inch San Andres pipe at an average weight of plate-iron of 42 lbs, per lineal foot weighs 400 multiplied by 42, equaling 16,800 lbs of plate-iron.

16,800 multiplied by 0.12 equals 2.016 pounds, or, in round figures, 2,000 pounds or one ton of crude asphaltum required for 400 feet of 30-inch pipe.

2. 276 barrels of coal tar used for 3,005,000 lbs. of plate-iron (in the 54-inch pipe) equals 276 barrels divided by 3,005,000 lbs,, equaling 0.00009184 barrel, or, in round figures, 0.000092 barrel of coal tar per pound of plate-iron in the 54-inch Alameda pipe.

400 feet of 30-inch San Andres pipe, containing 16,800 lbs. of plate-iron, would require 16,800 multiplied by 0.000092, equaling 1.5456 barrels of coal tar for dipping 400 feet of 30-inch pipe.

Mr. Carey does not give the weight of crude asphaltum used by him to dip, or required for the dipping

of 400 feet of 30-inch pipe in a day of ten hours. He only gives the coal tar used by him per day for dipping 30-inch pipe (of which he does not give the number of linear feet actually dipped by him).

All he says regarding the quantity of material used is: "I put half a barrel of gas tar to a kettle full of asphaltum. I used about two kettles of dip per day" (Defts.' Test., p. 44).

This shows that he used two half barrels, or one whole barrel, of tar a day; and if, therefore, he maintained complainant's standard of mixture, as he no doubt was compelled to do (which mixture, as above shown, would require 1.5456 barrels of coal tar for each 400 feet of 30-inch San Andres pipe), he could, as a maximum day's work, have dipped with his daily mixture containing only one barrel of coal tar, 1 divided by 1.5456, multiplied by 400 feet, equals 258.8 feet, or, in round figures, 259 linear feet a day, instead of 400 feet, as claimed by him that he could dip.

B.

If, instead of the weight of plate-iron basis, used by Mr. Schussler in his testimony, the superficial area basis, advocated by counsel for defendants is applied, then in order to ascertain how many linear feet of 30-inch San Andres pipe Mr. Carey dipped in a day, with his total daily mixture containing two half barrels, or one whole barrel of coal tar, we have the following result, based upon actual experience of complainant while dipping the 54-inch new Alameda pipe.

Experience With 54-Inch Alameda Pipe (Complainant's Test., p. 2703).

ASPHALTUM.

181 tons at 2,000 lbs. equals 362,000 lbs. crude asphaltum.

Superficial area of pipe covered with asphaltum coating, 477,000 square feet (Table XI).

362,000 lbs. asphaltum divided by 477,000 square feet equals 0.759 pounds, or, in round figures, 0.76 pounds of crude asphaltum used per square foot of pipe covered.

400 feet of 30-inch pipe, having a surface area to be covered with asphaltum coating of 15.6 square feet per linear foot of pipe equals 400 multiplied by 15.6, or 6,240 square feet of surface to be covered in 400 feet of 30-inch pipe.

6,240 square feet multiplied by 0.76 lbs. equals 4,742 pounds of crude asphaltum, which would, on the superficial area basis, be required for 400 feet of 30-inch pipe.

COAL TAR.

276 barrels of coal tar used for coating 477,000 square feet of 54-inch Alameda pipe equals 276 barrels divided by 477,000 square feet, equaling 0.000578 barrel of coal tar per square foot of pipe surface of the 54-inch Alameda pipe covered with asphaltum coating.

400 feet of 30-inch San Andres pipe containing (as above shown) 6,240 square feet of surface area would require 6,240 multiplied by 0.000578, equaling 3.6067 barrels, or in round figures, 3.60 barrels of coal tar for dipping 400 feet of 30-inch pipe.

On this superficial area basis therefore of calculating the asphaltum coating, as advocated by defendants' counsel, on page 229 of its brief, the one barrel of coal tar used per day, according to Mr. Carey's testimony, would cover only 1 divided by 3.6 multiplied by 400

feet, equaling 111 linear feet of 30-inch San Andres pipe, instead of the 400 feet which he claims he could have dipped in a day of ten hours, if the pipe had been made "fast enough" for him, while, upon the basis of weight of plate-iron covered, the daily quantity of mixture would have sufficed for coating 259 linear feet of 30-inch San Andres pipe per day.

The above analysis abundantly proves that all the deductions which counsel draw from their assumption that Mr. Carey actually did dip 400 feet of 30-inch pipe a day with the quantity of mixture which he says he prepared daily, are erroneous, and founded neither on Mr. Carey's testimony nor on facts—as 400 feet of 30-inch San Andres pipe, if calculated on the weight of plate-iron basis used by Mr. Schussler, in his testimony, would require 1.5456 divided by 1, equaling 1.5456, or fully 54 per cent more dipping material than Mr. Carey says he prepared daily—while, if calculated superficially, as advocated by counsel, Mr. Carey would have required 3.60 divided by 1.5456, equaling 2.32 times as much, or 132 per cent more dipping material for 400 feet of 30-inch pipe than the quantity which he says he prepared daily.

In regard to the item of cost of labor connected with the dipping of complainant's 54-inch Alameda pipe line, Mr. Schussler gives the following (Test. p. 2700);

"Labor for dipping and hauling until pipe was cooled and ready for shipment.....$4,695"

As before stated, the plate-iron in this pipe line weighed 3,005,000 pounds, which makes the cost per pound (exclusive of incidentals, etc.) of labor connected with the handling and dipping of this pipe $4,695 divided by 3,005,000 lbs., equaling 0.156 cents per pound of plate-iron.

Mr. Carey's statement as to the day's wages paid for a ten hour day, while dipping San Andres 30-inch pipe, is as follows. (Defendants' Test., p. 44):

"I had eight men and a boy employed in dipping pipe."

* * * * *

"We worked ten hours a day, and sometimes I could work them at night time. Two men got $2.50 per day and the rest for $2.00 a day. I received $3.50 a day, and the boy got not more than a dollar a day."

This shows the following daily payroll for Mr. Carey's work:

Mr. Carey	$ 3.50
Two men at $2.50	5.00
Six men at $2.00	12.00
One boy at $1.00	1.00
Total	$21.50 per day.

It appears, therefore, that with this daily cost of labor, all that Mr. Carey could dip (calculated by the weight of plate-iron), would be 259 linear feet of 30-inch San Andres pipe, weighing, at 42 lbs. a lineal foot, 10,878 pounds, at a cost for labor of $21.50 per day.

Dividing this $21.50 by 10,878, the total weight of plate-iron dipped in a day, we have 0.197 cents per pound as the labor cost, while Mr. Schussler's estimate of the cost of labor for dipping is 0.156 cent per pound (Test. pp. 1204-05), so that Mr. Carey's testimony, if true, shows a labor cost for dipping exceeding Mr. Schussler's estimate by full 26 per cent.

And, although the wages paid for labor were higher and the day's work shorter in 1903-04 than at the time when the 54-inch pipe was dipped, in 1902 (Test. p. 2702), Mr. Schussler, in his estimate of 1903-04, for

the cost of dipping pipe did not make any extra allowance above the wages paid by complainant for this work in 1902.

On page 231 of their brief, counsel for defendants say:

> "As Mr. Schussler's item of 15-100 of a cent per pound for labor of dipping includes the loading onto the cars, it is impossible to make a complete comparison with figures deducted from Mr. Carey's testimony."

This admission by defendants shows that it recognizes that Mr. Carey's testimony is incomplete, at least as to the loading the pipe onto the cars, which also, of course, includes the blocking up and fastening the same on the car.

Defendants then proceed:

> "Subject to allowance being made for this loading onto the cars, which in the case of the smaller pipe would be very much less than the Alameda 54-inch, the following comparison is submitted on some of the pipe dipped at about the time at which Mr. Carey was engaged on this work:
>
> Crystal Springs 44-inch pipe on basis of Mr. Carey's testimony:
>
> 87,260 feet (p. 986) divided by 400, gives, in round figures, 220 days, which, at $21.50 per day, equals $4,730.00.
>
> At unit of 15-100 of a cent per pound, 8,655,000 lbs. (p. 986) $12,982.50
>
> Alameda 36-inch pipe on basis of Mr. Carey's testimony:
>
> 143,150 feet (p. 1164) divided by 400 feet, gives 358 days, which, at $21.50 per day equals $7,697.00.
>
> At unit of 15-100 of a cent per pound—
> 10,028,000 lbs. (p. 1164) $15,042.00

"The huge disproportion between what was undoubtedly the cost of the labor employed in dipping the above pipe and figures based on Mr. Schussler's unit, cannot very well be accounted for by the loading onto the cars, and only goes to prove the unfairness of the basis adopted by Mr. Schussler."

To show the unfairness of these conclusions of defendants' counsel, it is necessary only to mention a few facts, which will also show the worthlessness of all the figures on asphaltum which enter into their cost estimates, as shown in their Table and in other places in their brief. In this Table (Brief, p. 232) they assume that Mr. Carey, with his daily quantity of dipping material and with the men employed, actually dipped 400 linear feet of 30-inch San Andres pipe; while, as above shown, his daily quantum was sufficient for only 259 feet of 30-inch pipe. On the erroneous assumption of a day's work of 400 feet of 30-inch pipe dipped daily, counsel, in their computation, class (as to cost of labor) the much heavier and larger Crystal Springs 44-inch and Alameda 36-inch pipes, in the same category with the cost of labor required for handling the light and short lengths of the San Andres repair pipe. In other words, they attempt to convey the impression that Carey's force of men, with which he claims he could have dipped 400 feet of 30-inch pipe in lengths of 20 feet, weighing about 42 pounds per lineal foot, could have dipped, in the same length of time 400 lineal feet of Crystal Springs 44-inch pipe, weighing (p. 986) 8,655,000 lbs., divided by 87,260 feet, or 99.18 lbs; or, in round figures, 99 pounds per lineal foot, or the same length of the Alameda 36-inch pipe, weighing (p. 1164) 10,028,000 pounds, divided by 143,150 feet, giving 70.05, or, in round figures, 70 pounds per lineal foot.

Besides this, complainant's pipes were usually manufactured in lengths of fully 28 feet in length before being placed into the dipping trough (Complainant's Test., p. 2698). Where, therefore, the weight (in plate-iron) of each 20 feet length of 30-inch pipe, dipped by Mr. Carey, was 20 feet multiplied by 42 lbs, giving 840 pounds; the weight of the same length of the 44-inch Crystal Springs pipe would be 20 feet multiplied by 99 lbs., giving 1980 pounds, and the weight of the 36-inch Alameda pipe of the same length would be 20 feet multiplied by 70 lbs., or 1400 pounds.

In other words, counsel, in order to arrive at the erroneous results given in their table, assume that the force of men which Mr. Carey says he used for the light 30-inch pipe could have dipped the 44-inch pipe, weighing 2 1-3 times as much, or the Alameda 36-inch pipe, weighing 1 2-3 times as much, with the same ease and facility and in the same time that he claims he could have dipped the much lighter 30-inch pipe.

Just prior to the Table (above quoted from page 232 of defendants' brief), in which Table counsel makes computations on the 44-inch Crystal Springs and on the 36-inch Alameda pipe lines, they say:

> "The following comparison is submitted on some of the pipe dipped at about the time at which Mr. Carey was engaged on this work."

This statement is certainly erroneous and misleading, as it is clearly shown in Mr. Reynolds' testimony (Table III) that the 44-inch Crystal Springs pipe was constructed mainly during the years ending June 30, 1885 and 1886, and the 36-inch Alameda pipe was constructed during the years ending June 30, 1888 and 1889. Therefore, the pipe in these lines was not

dipped at about the time when Mr. Carey says he dipped the 30-inch San Andres pipe. His testimony is that he was engaged in this work in 1880, which would be 5 or 6 years before the dipping of the Crystal Springs pipe and eight or nine years before the dipping of the Alameda pipe.

In addition to this, no allowance is made by defendants in their estimates, for the fact that, during the year 1903-04, for which Mr. Schussler's estimates are made for this suit, the wage schedule and the cost of labor performed per hour had largely advanced over those prevailing about the year 1880, when Mr. Carey says he dipped 30-inch pipe for the San Andres line.

Furthermore, as clearly shown in Mr. Schussler's testimony and in the above analysis, the cost of dipping, per pound, of plate-iron, increases with the decrease in the thickness and weight per square foot of metal. Mr. Schussler, having shown the actual cost of dipping the large and heavy 54-inch Alameda pipe (exclusive of incidentals, etc.), to have been, in 1902, 0.41 cent per pound of plate-iron, gave the defendants an advantage, therefore, by adopting the same figure per pound of iron for all of complainant's smaller and lighter pipes, as the cost of dipping calculated per pound of plate-iron, increases as the plate-iron becomes thinner.

By referring to complainant's Table XII, it will be seen that complainant's pipe lines made of lighter iron than that used in the 54-inch Alameda and the 44-inch new San Andres line, comprise fully 75 per cent of the total weight of plate-iron used in the pipe lines shown in that Table.

XI.

The Cost of Transportation.

Facts Shown by Mr. Schussler's Testimony Compared with Defendants' Computations and Deductions Therefrom.

Under "Transportation," Mr. Schussler comprises the shipping of the pipe from the shop where it was manufactured and coated with asphaltum to distributing centers, located conveniently to the route where the pipe is to be laid.

He says on this subject (p. 1200):

> "It includes the shipping of this pipe to a depot near the point where the pipe is to be laid—to a distributing center, so to speak—where that pipe is stacked up and covered with plank so as to keep the sun away from it, and thus prevent the melting off of the asphaltum."

In reference to his cost figures of transportation for the 54-inch Alameda pipe to Millbrae, where it was stacked up prior to being hauled away by teams and distributed along the proposed line, he says (p. 2708):

> "We have a freight cost for delivery of the pipe to the distributing depot on the line which, in this case, was our very convenient pipe yard at Millbrae, of 17-100 of a cent per pound."

As shown (Test. p. 1205), this cost of 0.17 cent per pound includes the freight on all fittings and also includes all switching charges.

In other words, Mr. Schussler, by adopting the transportation cost to Millbrae of 0.17 cents per pound of plate-iron, makes no additional allowance for railroad transportation to such portions of complainant's

pipe lines, the distributing centers for which were at a considerably greater distance from the manufacturing center.

The final item of labor, teaming, etc., includes cutting and trimming the trench and joint holes, leading the pipe on to wagons at the respective distributing centers, hauling it along the proposed pipe line, carefully unloading the same and distributing it along the line of the trench and protecting it from the sun; helping with the lowering of the pipe into the trench; repainting the riveted and caulked joints of the pipe, in and outside, of the pipe, with asphaltum coating, after the mechanics have finished them; inspection of mechanical work (night watchmen, time-keeper, foremen, machinist, carpenter); carefully packing and tightly ramming the excavated material underneath and on the sides of the pipe and over the same, and thus refilling the trench and restoring the surface of the ground; where the pipes were laid along the county road, reproducing the road in as good a state as it was found in before the trench was cut, and hauling away from the line of the completed pipe the surplus material left over, after filling the trench and restoring the surface.

In the case of the 54-inch Alameda pipe line, containing 3,005,000 pounds of plate-iron, the cost for this class of work (exclusive of incidentals, etc.), was $56,000, or 1.86 cents per pound of plate-iron.

Comparing this portion of the work of pipe construction on the 54-inch Alameda pipe line, with the similar class of work on the 44-inch new San Andres pipe line, Mr. Schussler's testimony says (p. 2668):

"But the pipe" (the 44-inch San Andres pipe) "going through the fields and the trenching being

very much heavier, the labor of digging the trench and laying the pipe and refilling the top was considerably more per pound."

X. Q. 4611: "Why was the trenching heavier?" A. "We had a good deal of work for the county on the road and also through the fields. We went through the fields of a man named Sylva; we went down pretty deep there and the ground was pretty hard. The Alameda pipe" (the 54-inch) "was laid principally on the road between Burlingame and Millbrae. We did not have quite so much labor and expense, when you figure it to the pound."

In regard to the item of work on the 54-inch Alameda line, Mr. Schussler says (p. 1207):

"This work, having been done mostly in 1903, when the conditions of prices of labor and the length of the day's work were as they are now, gives us the best criterion that we have of the exact cost for the whole, the cost per pound of similar work."

As will be seen by reference to Table III of this appendix, the 44-inch San Andres pipe line was laid in the year 1898, or at a period when wages of common labor were still at the low standard of 20 cents an hour and the day's work lasted ten hours. This item of work on the pipe line is composed mostly of common labor and teaming. During the period of 1903-04, for which Mr. Schussler's estimates on the cost of reproducing complainant's works are made, the cost of a day's work had increased from $2 for 10 hours to $2.50 for an eight hours' day's work. This large item of labor, therefore, shows an increase between 1898 and 1903-04 of fully 50 per cent.

Referring to the cost per hour of the common labor employed in the construction of the new 44-inch San Andres pipe line, Mr. Schussler says (p. 2187):

X. Q. 2814: "Would it cost any more to lay that in 1903 or 1904 than in 1898?"

A. "Yes, sir, labor has gone up considerably since."

X. Q. 2815: "How much?"

A. "We paid the ordinary laborer at that time about $2 a day, or, in other words, 20 cents an hour; they now receive 31¼ cents an hour."

X. Q. 2816: "You worked them 10 hours a day in 1898, did you not?"

A. "Yes, 10 hours a day."

X. Q. 2817: "When did you begin to pay $2.50 a day for 8 hours?"

A. "I think it was begun at the beginning of the year 1903."

Coupling this increase in cost of labor per hour with the fact, above quoted, that the item of labor and hauling, connected with the laying of the 44-inch San Andres pipe was more difficult and costly per pound of plate-iron (under equal conditions of cost of labor and teaming) than the corresponding work on the 54-inch pipe (which cost 1.86 cents per pound), it will be seen that this item of construction for the 44-inch San Andres pipe, if reproduced in 1903-04, would cost considerably more per pound than on the 54-inch pipe.

This extra cost for the 44-inch San Andres pipe, based upon the cost of labor in 1903-04, is taken cognizance of in Mr. Schussler's estimate of cost of reproduction of the San Andres pipe line in 1903-04.

Although the specific item for this portion of work on this pipe line is not segregated by him in his testimony, it can be easily obtained by reference to his testimony as to what it would cost (in 1903-04) to reproduce the present San Andres pipe line, of the

same grades of iron and materials contained therein, and of the same workmanship employed in its construction.

Speaking of the comparative total cost per pound of plate-iron (exclusive of incidentals, etc.), of the 54-inch Alameda pipe, as compared with the present San Andres pipe line, both estimates being based upon the cost in 1903-04 of the respective materials used and labor performed, Mr. Schussler says (p. 1208):

> "This total cost of 10.87 cents per pound" (of plate-iron in the 54-inch Alameda pipe) "is somewhat higher than our average has been and would be, even under the present circumstances. We have had pipes that run up to about 10.40 cents per pound" (under the present circumstances) "whereas this is 10.87 cents, and even in that pipe the *iron happened to be bought at a time when the market was depressed in the East, and the extreme high grade of iron that we are using, this first-class iron we used in the 54-inch pipe, was not obtainable, consequently we had to be contented with a somewhat less grade of iron; but, owing to the fact that the labor of laying pipe was under more difficult circumstances, requiring a greater expenditure of labor per pound of iron in the laying of the pipe, the total nearly balanced itself, so that the total of that pipe was ** about 10.4 cents a pound, whereas the pipe I am now speaking of" (the 54-inch Alameda) "was 10.87 cents a pound. We cannot always expect to hit the market at the lowest stage, and, secondly, we shall always try to get the high-grade material we have adopted for the bulk" (of the length) "of the San Andres pipe line as well as for the Crystal Springs 44-inch pipe line and the Alameda Creek 36-inch pipe line, and particularly for the 54-inch Alameda pipe line."

* bulk of the

** (estimated for 1903-04)

Mr. Schussler's testimony not specifying for the San Andres pipe line the separate cost of labor, hauling, etc., connected with the laying of the pipe (of which he gives the cost per pound complete, exclusive of incidentals, etc., at 10.4 cents per pound of plate-iron), we arrive at the figure for labor, etc., by a process of elimination, as follows:

On Table VI the average present cost, delivered in San Francisco of the 5,393,000 pounds of the plate-iron in the San Andres pipe line, is shown to be 4 cents a pound.

As shown on Table VIII et seq. of this brief, the average contract cost of the mechanical work of manufacturing and laying the four pipe lines last constructed for straight pipe, combined with the cost of all extra mechanical work of the contractor, equals, if not exceeds, the cost (including extras) of the 54-inch new Alameda pipe of 3.39 cents per pound of plate-iron.

The other items, of dipping in asphaltum at 0.41 cent, rivets at 0.17 cent, and transportation at 0.17 cent per pound of plate-iron, enter into Mr. Schussler's estimate of 10.40 cents per pound of plate-iron, contained in the present San Andres pipe line.

By adding together the above list of items and deducting the sum from Mr. Schussler's estimate for the present cost of reproduction of the present San Andres pipe line, we have:

For plate-iron	4.00 cents;
For rivets	0.17 cents;
For mechanical work of manufacturing and laying pipe, including extra work	3.39 cents;
For asphaltum coating	0.41 cent;
For transportation	0.17 cent;
Total, per pound of plate-iron	8.14 cents.

By deducting 8.14 cents from the total amount of 10.40, we have 2.26 cents a pound of plate-iron, as Mr. Schussler's estimate of the cost in 1903-04 of the work of all labor, teaming, etc., in connecting with the trench and hauling and laying the pipe in the same, not including the charge of the contractor for mechanical work.

In the case of the Crystal Springs 44-inch pipe line, which, for a large portion of its route, was laid over undulating ground, along side hills, difficult of access, along crooked and narrow roads, considerable extra expense was incurred in the labor and teaming item and other work connected with the hauling of the pipe to the trench and placing it in the same, as above detailed.

Based upon his experience in this matter, in his testimony regarding this line, Mr. Schussler places his estimate of cost of reproduction in 1903-04 of this part of the work, where the pipe was placed in the trench, at 2.40 cents per pound of plate-iron. (Test. pp. 906-7.)

This estimate indicates that the difficulties to be overcome in the labor and teaming item of the laying of this pipe line were greater and cost more per pound of plate-iron than in the case of the San Andres pipe line.

In reference to the character of the ground traversed by the 44-inch Crystal Springs pipe line, Mr. Schussler says (p. 979):

> "The Crystal Springs 44-inch pipe line begins, as heretofore mentioned, at the gate-house or at the regulating gate at the Crystal Springs dam, runs down the San Mateo canyon and emerges from it about a mile and a half westerly from the town of San Mateo; then it goes over the hills in a direction more or less straight, toward a place called

'Burlingame,' where it leaves the private property and goes on the county road. It follows then the county road past Millbrae and San Bruno; then it veers off in a northerly or northeasterly direction along the county road, past San Bruno railroad station, to the County of San Francisco, around Sierra Point, follows the shore line of the Bay of San Francisco on the side hill, at an elevation of from 50 to 60 or 70 feet above tide, and finally terminates in a tunnel, which is drifted and bricked, through a range of hills located northerly from what is known as Visitacion Valley, which is the most southerly portion, or the most southeasterly portion of San Francisco County; after making its exit again from the northerly end of the tunnel, it again, in the shape of a 44-inch pipe, crosses a valley and finally discharges into the screen-house, near the southeast corner of the University Mound Reservoir in San Francisco City and County, at an elevation of from 160 to 170 feet above tide."

The general description of the route of the Crystal Springs conduit line indicates not only the uneven and difficult character of the larger portion of the same, but it also shows that the item of hauling, although not as difficult and expensive as the 30-inch Pilarcitos pipe line was greater than that of the other pipe lines of the complainant, when calculated per pound of plate-iron.

Regarding the transportation of the 44-inch pipe line, Mr. Schussler says (p. 2706):

X. Q. 4675: "How was the Crystal Springs pipe transported?"

A. "I think the Crystal Springs pipe was transported principally by rail to that portion which lies close to the railroad, making San Bruno station, for instance, one of the main delivery depots. The portion that was laid along the Bay front, past the

Visitacion Valley and into the southeasterly portion of San Francisco, where there was no railroad near by, there it was put on wagons and hauled out. That, of course, made transportation considerably dearer. Wherever we can transport the pipe by rail, of course, we do it. When it is inconvenient and too far away from the railroad, then we naturally have to go to teaming."

The cost, for 1903-04, of the above item of labor, hauling, etc., connected with the laying in the trench complete of the 44-inch Crystal Springs pipe line, of 2.4 cents a pound of plate-iron, is given by Mr. Schussler's testimony as follows (pp. 986-7):

"As I stated before, a part of this pipe is laid on trestles and the large balance is laid in the ground. It does not cost as much to lay the pipe on trestles as it does to lay it in the ground, barring the cost of the trestles. I have the cost of the trestles figured separately, so for the distance of 6,800 feet, in round figures, that the pipe has been laid on trestles, I have made the proper allowance as to the saving of cost of laying that pipe. All of the pipe laid on trestles, piles and piers, was the No. 6 iron, weighing 101 pounds per lineal foot of pipe of plate-iron, making the total weight of plate-iron thus laid on piled bridges, trestles and piers 686,800 pounds, which cost 8.6 cents a pound complete—riveted together, manufactured, transported out, dipped in asphaltum and connected together by riveting, thoroughly chipped, split and caulked and painted, but exclusive of cost of trestle, and covering put on the pipe. The average saving of laying the pipe on the trestle, instead of making a ditch and laying it in the ditch and digging the joint-holes and connecting it again is 2 cents a pound. The item of 2 cents a pound is brought about in this manner; where the pipe is laid in the ditch, the cost per pound of plate-iron for digging the trench, for putting in the pipe,

for blocking it up, for digging the joint-holes, for'' (the purpose of) ''riveting it together, splitting, chipping and caulking the joints, painting it, ramming the ditch full again with good, first-class material, covering it up again, and in fact putting in the pipe complete* cost 2.4-10 cents per pound. The difference in the cost per pound compared with laying it on the plain top of the trestle is 2 cents a pound. The labor of putting it on the trestle is 4-10 of a cent per pound. Deducting that 4-10 from 2 4-10 cents per pound that it costs to place the pipe complete in the ditch leaves a net difference in favor of placing it on the trestle of 2 cents a pound.''

At the beginning of this present chapter the common labor, hauling, etc., required for laying the pipe in the trench, has been described in detail. As will there be seen, the cost of digging the trench for the reception of the pipe forms a portion of this work, as detailed above.

Counsel for defendants (on page 238 of their brief) in order to show what it claims to be the original cost of this digging for the original 30-inch San Andres pipe line (which was laid about 1870-71, see Table II), again quotes from the minutes of complainant's Board of Directors, dated May 1, 1870, as follows:

''The President informed the board that the contract for digging the ditch of the Bald Hill line had been let at 23 cents per lineal foot'' (p. 365).

But, as in another instance previously cited, there is no evidence that the work was completed for the contract price, and there is evidence from which it is reasonable to infer that it was not. This we will show hereafter.

Referring to the original construction, in 1887-8, of the 36-inch Alameda pipe line, counsel, in order to

*(Exclusive of mechanical work.)

show their version of what they construe to be the ultimate cost per pound then, of the corresponding item of labor, teaming, etc., as heretofore fully detailed under the head of the 44-inch Crystal Springs pipe, again resort to complainant's minutes, from which, on page 236 of their brief, the following is quoted:

"Transporting to and distributing along line, 139,400 feet of pipe at 15.64 per foot.$21,000.00
"Digging 120,400 feet ditch, 25.913—1,000 per foot 31,200.00
"Filling and ramming 120,400 feet ditch, 17.441 ..... 21,000.00
"Digging 4,300 joint-holes at $1.00 each.. 4,300.00

Counsel then say: "These figures total up to $77,500.00 The total weight of the pipe laid in the ditch, on the Alameda 36-inch pipe line, is given by Mr. Schussler at 8,578,000 pounds (page 1165), which, divided into the contract price of $77,500.00 would give a unit of .903 cents per pound."

Again there is no evidence that the work was completed for these contract prices.

As heretofore shown, in the case of other pipe lines, notably the 44-inch new San Andres and the 54-inch new Alameda, the final settlement with the respective contractors for the mechanical work alone, including extras, showed a considerable additional cost over the originally mentioned contract price. In this case of the 36-inch Alameda pipe line, the contractor undertook not only the mechanical work, but also the transportation and the laboring work connected with the laying of the pipe. The final total settlement for all of the contract work and the extra work performed by him, is not given in the testimony.

Judging from the total cost of this line, as charged in complainant's books, as shown in the analysis of this

line (Table IV) it will be found that the average cost per pound of plate-iron of the completed pipe, with which this pipe line has been charged, far exceeds the average estimated cost of reproduction in 1903-04, of 10.6 cents per pound, adopted by Mr. Schussler in his estimates for all of complainant's pipe lines.

Furthermore, the cost for this entire pipe line, given in complainant's books, even after being modified by deductions of items included therein (Table IV), is so high, when compared with what the total cost would be, if based alone upon the various contract prices, as quoted in defendants' brief from complainant's minutes, that it is evident that additional payments must have been made to the contractor for extra work (both mechanical and laboring) on the entire pipe line.

To show what changes did occur in the length of the original pipe line, as actually constructed, when compared with the length quoted by defendant from the minutes, on page 236 of its brief, the following examples are given:

On Table IV of this appendix the length of the original Alameda 36-inch pipe, as then manufactured and laid, is shown to be 144,135 feet, while the minutes give the length at 139,400 feet, showing that the originally contemplated length was increased.

Of the entire actual length of the pipe as laid, there were laid on trestles 18,960 feet (Test. p. 1165). By deducting this length on trestles from the above total length of 144,135 feet actually laid, we have 125,175 feet of pipe laid in the trench, and not 120,400 feet, as quoted from the minutes by defendant.

This increase in length of pipe in the trench also affected, in the same proportion, the original item (in the minutes) of filling and ramming. The minutes, as quoted on page 236 of defendants' brief, calling for

4,300 joint holes for an assumed length of pipe in the trench of 120,400 feet, allows for one joint hole for every 28 feet in length. The length of pipe, therefore, as actually laid in the trench, of 125,175 feet (and not allowing for extra joint holes at all the curves) increases the number of joint-holes on the straight, from the number mentioned in the minutes, to 4,470.

These examples go to show, as was already shown in the case of other pipe lines of complainant, and as will be shown, for instance, in the case of the Pilarcitos dam, that on the Alameda 36-inch line, it is not safe to use as the only basis for the final total cost of this structure notes from complainant's minute books. As shown heretofore, all extra cost charges, over and above the original contract prices must be ascertained in addition to the incomplete data as to the contract price furnished by the minutes.

As another illustration of a deduction drawn by counsel from theories, which are not supported by facts in practice, the following quotation is taken from defendants' brief, page 235, in connection with trench work. After referring to cost figures per pound of plate-iron regarding transportation, trench and other work on the 54-inch Alameda pipe line, they say:

> "On these two items, the charges on the big Alameda 54-inch pipe, owing to its dimensions, would, of necessity, be far in excess of the rates on the smaller pipes; the trench would have to be dug much deeper, and so forth. Conditions as between the Alamenda 54-inch and the smaller pipes being so different, comparisons of cost are not easy to make."

They then quote from Mr. Schussler's testimony as to the width and depth of the trench for the Alameda 54-inch pipe.

" 'Meanwhile a force of men has been digging the pipe ditch which, in the case of our last 54-inch Alameda pipe, had to be nearly 7 feet wide and between 7 and 8' (deep) 'in order to place this large pipe at a sufficient depth with a safe margin of material over the top. In some places we had to go even deeper on account of cutting through rounded hills and straightening out the line; in some places it was somewhat shallower.' " (page 782.)

More careful investigation would have shown counsel that the charges on the big Alameda 54-inch pipe per pound of plate-iron would be relatively less instead of "far in excess of the rates on the smaller pipes."

To furnish the complete information, for the purpose of showing how faulty are counsel's reasoning and deduction in this matter, the following is quoted from Mr. Schussler's testimony, regarding the dimensions of the trench for the Pilarcitos 30-inch pipe line (p. 2562):

X. Q. 4557: "What depth?"

"A. "That I do not know, but we usually carry about 2½ feet of dirt on top of the pipe. On the Pilarcitos 30-inch pipe we had a trench generally about 5 feet wide."

As the figures regarding the cost of trench work and all other work connected with complainant's wrought-iron pipes, are expressed in Mr. Schussler's testimony in cents per pound of plate-iron, and as it is in this mode of expressing the cost that defendants' above quoted structure refers to, it will be necessary only to establish the number of cubic feet of earth that has to be excavated for each linear foot of 54-inch pipe on the one hand, and of 30-inch pipe on the other. We will then take from Mr. Schussler's testimony the average weight of plate-iron in the lineal foot of 54-

inch Alameda pipe and in the 30-inch Pilarcitos pipe, respectively, and by dividing the latter number of cubic feet in each trench, by the respective number of pounds of plate-iron in each pipe line, we shall get the relative comparative result as to how much earth had to be excavated and handled for each pound of plate-iron in the case of the 54-inch pipe, and how much in that of the 30-inch pipe.

The trench for the 54-inch Alameda pipe being 7 feet by 7½ feet requires 52.5 cubic feet of excavation per lineal foot of trench.

The 16,758 feet of that pipe contain 3,005,000 pounds of plate-iron (Table IV), which makes 179.30 pounds per lineal foot. By dividing the above 52.5 cubic feet of excavation per lineal foot by the 179.30 pounds of plate-iron in each lineal foot of pipe, we have as a result 292-1000 of a cubic foot of trench excavated for each pound of plate-iron in the 54-inch Alameda pipe.

The trench for the 30-inch Pilarcitos pipe line, being 5 feet by 5 feet, requires 25 cubic feet of excavation per lineal foot of trench. The 68,346 feet of that line contains 2,843,000 pounds of plate-iron (Table IV), which makes 41.96, or, in round figures, 42 pounds per lineal foot. By dividing the above 25 cubic feet of excavation per lineal foot by the 42 pounds of plate-iron contained in each lineal foot of this pipe, we have as a result 595-1000 of a cubic foot of trench excavated for each pound of plate-iron in the 30-inch Pilarcitos pipe line.

These two results show that, instead of the "charges on the big Alameda 54-inch pipe, owing to its dimensions," being of necessity "far in excess of the rate on the smaller pipes;" the reverse is the fact. The above comparative example shows that the amount of excavation per pound of plate-iron in the 30-inch

pipe line is just about double that which is necessary for the 54-inch pipe per pound of plate-iron.

Mr. Schussler, having based his cost estimates on the trench work on the basis of cost for that of the larger pipe, and having adopted the result so obtained for all of the pipes, including the smaller ones, has thus arrived at a much more conservative estimate than if he had followed defendants' theory of estimating the cost of trench work for the larger pipes by taking as a basis the cost of this work per pound of plate-iron in complainant's smaller pipes.

XII.

Mr. Schussler's Estimate of 10.60 Cents a Pound.

His Testimony Shows How He Arrived at This as an Average.

As stated throughout his testimony, Mr. Schussler's estimates of complainant's constructed works are based upon the conditions of cost of materials and labor, both mechanical and common, ruling in 1903-04, and they give, according to his judgment and experience in the construction of works of this character, what the works would cost to construct, if they were to be reproduced now.

In his estimates for complainant's pipe lines, he has used as a basis the present cost of that grade of iron which was used in the respective pipe lines, as shown on Table VI.

As heretofore shown, the actual cost (exclusive of incidentals, etc.), per pound of plate-iron, of the new 54-inch Alameda pipe line was 10.87 cents. The plate-iron used in this line, delivered at the shop in San Francisco, cost 4.87 cents per pound. Deducting the latter from the former figure, we have 6.00 cents per

pound of plate-iron, which represents and includes all the mechanical work of manufacturing and laying the pipe, including all fittings and all extra mechanical work; all cost of rivets, asphaltum coating, transportation, hauling and distributing the pipe, digging trench and joint holes, filling and ramming same, and all extra work and labor connected with such work of laying the pipe line.

The cost of reproduction in 1903-04 of the present San Andres pipe line, as heretofore shown, is conservatively estimated at 10.40 cents per pound of plate-iron. The average present cost, delivered at the shop in San Francisco, of the plate-iron used in this line, as shown in Table VI, is 4.00 cents a pound. By deducting this latter figure from the above total of 10.40 cents, we have 6.40 cents per pound of plate-iron as the cost for all of the mechanical and common labor and materials and extra work, etc., employed in constructing this pipe line in 1903-04 (outside of the cost of plate-iron).

Mr. Schussler, in making his estimate for the average cost per pound of plate-iron contained in complainant's pipe lines of 10.60 cents per pound (Test. p. 1208) arrived at this result by taking the average between a pipe line with a higher cost of iron and a lower cost of labor, costing 10.87 cents per pound on the one hand, and a pipe line with a lower cost of iron and a higher cost of labor, costing 10.40 cents a pound on the other hand. The average, so obtained, being 10.63 cents per pound, was rounded off to 10.60 cents per pound of plate-iron. His testimony shows that in this estimate on the cost of reproducing complainant's pipe lines he took cognizance of the fact that on account of

more costly trenching and greater difficulty of access on the San Andres and Crystal Springs and Pilarcitos lines (as indicated on exhibits Nos. 21 and 22) the cost of common labor for hauling, trenching, filling, etc., was higher per pound of plate iron than the corresponding work on the 54-inch and 36-inch Alameda pipe lines.

As shown on Table VI, the total combined weight of plate-iron in the Pilarcitos, San Andres and Crystal Springs pipe lines is 16,871,800 pounds, while that in the two Alameda lines is 13,033,000 pounds, the former overweighing the latter by over 3,800,000 pounds. If Mr. Schussler had taken that fact into consideration he would have been justified in increasing his average on account of the higher average cost of common labor required for hauling, trenching, filling, etc., and extra work on the combined greater weight of the three peninsular lines (Pilarcitos, San Andres and Crystal Springs).

The fact that he did not do so tends to show that he was conservative in his estimate.

XIII.

Mr. Schussler's Estimates Compared.

A Comparison Between His Estimated Cost of Reproduction and the Direct Cost Charges Shown by the Accountants.

It will now be in place, as a recapitulation of what has been heretofore shown, regarding the wrought-iron pipes of complainant, to determine how the cost of their reproduction in 1903-04, as estimated by Mr. Schussler in his testimony, will compare with their original cost, as shown in the respective direct total

cost charges, according to complainant's accounting department, and as given in Mr. Reynolds' testimony (Table II and Table III).

In the following comparison, complainant's pipe lines will be designated and numbered as follows:

A. Pilarcitos pipe line;
B. San Andres pipe line;
C. Crystal Springs pipe line;
D. 36-inch Alameda pipe line; and
E. 54-inch Alameda pipe line.

A.

Pilarcitos Pipe Line.

The wrought-iron portion of the present Pilarcitos pipe line consists of 65,170 feet of 30-inch and 2,400 feet of 22-inch pipe, containing a weight of plate-iron of 2,823,800 pounds (Test. pp. 785-6, Table VI).

Mr. Schussler's estimate of cost of reproducing, in 1903-04, this present wrought-iron Pilarcitos pipe will be (exclusive of 10 per cent for incidentals, etc.) 10.60 cents per pound of plate-iron, which, as shown in his testimony, would amount to $287,366.00 for the 65,170 feet of 30-inch pipe, or 2,711,000 pounds of plate-iron; and $11,957.00 for the 2,400 feet of 22-inch pipe, or 112,800 pounds of plate-iron; being a total of $299,-323.00 for the pipe containing 2,823,800 pounds of plate-iron, or 10.60 cents a pound.

The original Pilarcitos 30-inch pipe line, as laid about the years 1867-69 (Table II) had a total length of 30-inch pipe of 68,346 feet (Table IV), and contained a weight of 2,843,000 pounds of plate-iron. The direct charges made by complainant's accounting department to the construction of this original Pilarcitos pipe line (Table II and Table IV) amounted to $388,883.60.

This original pipe line, with its 68,346 feet of 30-inch pipe, contained 2,843,000 pounds of plate-iron against the 2,823,800 pounds contained in the present Pilarcitos pipe line. In other words, the weight of plate-iron in the original pipe exceeded that in the present pipe by 0.68 per cent.

In order to make a fair comparison between the total direct cost charges to the original pipe line and Mr. Schussler's estimate of cost of present reproduction of the present Pilarcitos pipe line we will reduce the above original cost of $388,883.60 in the proportion that the weight of the present pipe is below the weight of the original pipe:

$$\frac{100 \times \$388,883.60}{100.68} = \$386,257.05.$$

This gives us the following comparative result:

Mr. Schussler's estimate of present cost of reproduction of the present Pilarcitos pipe line (exclusive of 10 per cent for incidental, etc., expenses):	Direct charges to original cost of construction from complainant's books of original Pilarcitos pipe line, reduced to the same weight of plate-iron as contained in the present Pilarcitos pipe line:
$299,323.00.	$386,257.05.

B.

San Andres Pipe Line.

The present San Andres pipe line consists of 28,830 feet of 44-inch, 1,400 feet of 37-inch and 39,300 feet of 30-inch wrought-iron pipe, containing a total weight

of 5,393,545 pounds of plate-iron, or, in round figures, 5,393,000 pounds of plate-iron (Test. p. 869). Mr. Schussler estimates the cost of reconstruction of this in 1903-04 (exclusive of 10 per cent for incidentals, etc.) of the present San Andres pipe line at 10.6 cents per pound, or $571,658.00 (Test. p. 870).

The weight of plate-iron contained in that portion (39,300 feet in length) which is a part of the original 65,300 feet of 30-inch San Andres pipe line (Table IV) is 1,473,750 pounds (Test. p. 869).

The proportion of the direct cost charges for the original construction of the 30-inch San Andres pipe line, as shown in the previous discussion of this pipe line, is included in the total sum of $524,000, representing the total direct cost charges due to the original construction of the present San Andres pipe line. (See also Table XIV.)

For the present San Andres pipe line, we therefore have the following comparative results:

Mr. Schussler's estimate of present cost of reproduction of the present San Andres pipe line (exclusive of 10 per cent for incidental, etc., expenses):	Direct charges to original cost of construction, as deduced from complainant's account books—of the now remaining portion of the original 30-inch San Andres pipe line and of the "New San Andres pipe line"—the two constituting the same present San Andres pipe line, estimated on by Mr. Schussler in his testimony:
$571,658.00	$524,600.00

C.

CRYSTAL SPRINGS PIPE LINE.

The present Crystal Springs pipe line estimated on by Mr. Schussler consists of 87,260 feet of 44-inch wrought-iron pipe, of which 66,900 feet, being of No. 6 iron, contains 6,756,900 pounds of plate-iron, while the remaining 20,360 feet of No. 7 iron contain 1,898,570 pounds of plate-iron, making a total weight of plate-iron in the entire 87,260 feet of pipe of 8,655,470 pounds, or, in round figures, 8,655,000 pounds.

Of this total length of pipe, there is laid on trestles 6,800 lineal feet, containing 686,800 pounds of plate-iron. The balance of the pipe, which contains 7,968,-670 pounds of plate-iron, is laid in the trench.

Mr. Schussler's estimate for the average cost of the pipe (exclusive of 10 per cent for incidental, etc., expenses) laid on trestles (but not including the cost of the trestles) is 8.60 cents per pound of plate-iron. (pp. 986-9). For the pipe laid complete in the trench, his estimate is 10.60 cents per pound of plate-iron. The specific estimates and total results are as follows (Test. p. 989).

1. The 686,800 pounds laid on trestles, at 8.6 cents per pound	$ 59,064.00
2. The 7,968,670 pounds laid in the trench, at 10.6 cents per pound	844,679.00
3. The trestles on this pipe line	27,168.00
4. A short tunnel (300 feet in length), in which pipe was solidly bricked in	8,370.00
5. A longer tunnel, 2,145 feet in length (without having the pipes bricked in)	45,317.00
6. A screen house at northern or city terminus of Crystal Springs pipe line, at the University Mound Reservoir in San Francisco	11,707.00
Total	$996,305.00

This total estimate of $996,305.00 does not include 10 per cent for incidental, contingent, engineering, superintending, etc., expenses.

The total cost therefore (exclusive of incidentals, etc.) of reproduction in 1903-04 of the 44-inch wrought-iron pipe in the present Crystal Springs line (exclusive of the four special structures as above enumerated) is arrived at by deducting from Mr. Schussler's estimate of $996,305.00 his estimates for the above four special structures numbered 3, 4, 5 and 6, amounting to $92,562.00, leaving $903,743.00 (page 989) for the 87,260 feet of present 44-inch Crystal Springs pipe, exclusive of the special structures.

As heretofore shown in the analysis of direct and general cost charges of complainant's accounting department, and as tabulated in Tables II and III, and hereinbefore discussed and analyzed, there appears to be no doubt that portions of the cost of structures tabulated (and particularly the incidental, contingent, salary, etc., expenses), that should have been directly charged to each specific structure to which they belong, have found their way into the large general "New Construction Account."

As heretofore shown, the general new construction account for the period of about thirty-eight and one-half years, from June 1st, 1865, to December 31st, 1904 (as shown in Tables II and III), represents 35.37 per cent of the total cost charges made during this period to the structures enumerated in these tables, while the direct cost charges, allotted to the same specific structures, during the same period, represent the remaining 64.63 per cent of the total cost charges shown in Tables II and III of $19,177,731.77.

It is therefore safe to assume that a detailed and careful scrutiny would have disclosed that the gen-

eral new construction account, for many of the structures specified in Tables II and III (including the important and most costly item of complainant's wrought-iron pipes) contains many charges that belong to the original cost of specific structures enumerated, and should have been added thereto.

The original cost figures, however, used in this comparative analysis, take no cognizance of the probability of the general account carrying additional cost items, but are taken exclusively from the list of direct cost charges only.

The original 44-inch Crystal Springs pipe line, as laid about 1884-6, consisted of 95,660 feet of pipe (Table IV). On this same line, there were, at the same time, constructed other structures, above enumerated, consisting of two tunnels, 300 and 2,145 feet in length, respectively; trestles, of a total length of 6,800 feet; and a screen house, at the northern terminus of this pipe line, at the University Mound Reservoir.

As no special mention is made in Mr. Reynolds' testimony (Table III) on the subject of these special structures, in connection with the "Crystal Springs pipe line," we will assume that the original cost of these four special structures is included in his total direct cost account of the "Crystal Springs pipe line" of $1,036,163.43.

As above shown, the present length of the Crystal Springs pipe line is 87,260 feet, while the original length, as laid about 1884-6, was 95,660 feet (the difference between the original and present length, of 8,400 feet, having been taken up a number of years ago and removed to other places).

The weight of plate-iron, contained in these 8,400 feet of pipe, was, as previously shown in the discus-

sion herein, on the original status of the Crystal Springs pipe line, 806,800 pounds, all of this part of the pipe having been originally laid in the trench.

The total weight of plate-iron contained in the original 95,660 feet of 44-inch Crystal Springs pipe line was 9,461,800 pounds (Table IV), which total weight includes the above weight in the 8,400 feet, of 806,800 pounds.

In order to arrive, as near as practicable, at a comparison of the original direct cost charges, due to that part of the original Crystal Springs line as it exists now, we will, from the total direct cost charges for the entire original line, as given by Mr. Reynolds, at $1,036,163.43 (Table III), deduct the proportional cost charge, due to the original construction of the 8,400 feet of pipe, above mentioned, which, having been removed prior to the time when Mr. Schussler made his cost estimate, are not included in his estimates of cost of reproduction of the present Crystal Springs line.

For the purpose of estimating the original direct cost charges for these 8,400 feet of original pipe, since removed (in the absence of their detailed original cost figures), we will first deduct from Mr. Reynolds' total direct cost charge of $1,036,163.43 Mr. Schussler's cost estimates for the present reproduction of these four special structures, as above enumerated. The balance thus left will represent, as near as is practical to obtain them now, the total direct cost charge due to the original construction of the entire original 44-inch Crystal Springs pipe line, exclusive of the four above special structures.

These four special structures, on the original as well as on the present Crystal Springs line, are, as above enumerated and estimated for 1903-04:

Trestles	$27,168.00
Short tunnel	8,370.00
Long tunnel	45,317.00
Screen house	11,707.00
Total	$92,562.00

$1,036,163.43, less $92,562.00, leaves $943,601.43, or, in round figures, $943,600, for the 95,660 feet of original Crystal Springs 44-inch pipe, containing a total weight of plate-iron of 9,461,800 lbs.

As above shown, the 8,400 feet of pipe removed from the original line, having a weight of plate-iron of 806,800 lbs., represents $8.\frac{527}{1000}$ per cent, or, in round figures, 8½ per cent of the total weight of plate-iron in the entire original pipe line.

If we deduct 8½ per cent, or, in round figures, $80,000, from the above balance of $943,600, we have $863,600 as the proportion, as near as ascertainable, of the direct cost charges due to the original construction of the present 87,260 feet of 44-inch pipe line, after eliminating the four special structures above mentioned and the 8,400 additional feet of 44-inch pipe, since removed.

To arrive at the total of the original direct cost charges, due to that part of the Crystal Springs line, as it now exists, and on which Mr. Schussler's present estimates have been made, we will again add to the above $863,600 the above $92,562.00 (being his estimate on the four special structures), which (for the purpose of ascertain-

ing the approximate original proportional cost charges due to the 8,400 feet of pipe removed) had been $956,162.00, or, in round figures, $956,000, which represents the total original direct cost charges by complainant's accounting department, due to the original construction of that part of the work, which now, and in Mr. Schussler's estimates, represents the present Crystal Springs pipe and conduit line.

For the present 44-inch Crystal Springs pipe line therefore (exclusive of the extra structures on the same, as above enumerated, namely: trestles, tunnels and screen house), we have the following comparative results:

Mr. Schussler's estimate of present cost of reproduction of the pipe portion of the present 44-inch Crystal Springs pipe line (exclusive of 10 per cent for incidental, etc., expenses):	Direct charges to the original cost of construction, as deduced from Mr. Reynolds' testimony (as above shown) of that portion of the original 44-inch Crystal Springs pipe, which now, and in Mr. Schussler's estimates, constitutes the pipe portion of the present Crystal Springs pipe line (exclusive of special structures):
$903,743.00	$863,600.00

D.

36-Inch Alameda Pipe Line.

The present 36-inch Alameda pipe line, on the cost of reproduction of which in 1903-04 Mr. Schussler makes his estimate, is shown to have a total length of 143,150 feet (p. 1164), of which length 60,805 feet consists of No. 7 iron and contains 4,651,580 pounds of plate-iron; while the remaining 82,345 feet consists of No. 9 iron and contains 5,377,130 pounds of plate-iron; making a total weight of plate-iron in the entire present pipe line of 10,028,710 pounds, or, in round figures, 10,028,000 pounds. Of this total weight, there is laid on trestles 1,450,000 pounds, which Mr. Schussler estimates to cost, in 1903-04, exclusive of the cost of the trestle and of 10 per cent for incidentals, etc., $124,700.00 (p. 1165). The remainder of the present 36-inch pipe line, which is laid in the trench, and which contains 8,578,000 pounds of plate-iron, is estimated by him to cost to reconstruct in 1903-04, complete in the ground (exclusive of 10 per cent for incidentals, etc.), $909,270.00; making his total cost estimate (exclusive of 10 per cent for incidentals, etc.) of the entire present 143,150 feet of 36-inch pipe, complete in the trench and on the trestles (exclusive of the cost of the trestles), $124,700, plus $909,270, or $1,033,970.00 (Test. p. 1165).

As shown in Table IV, and as fully detailed prior to this table, under the head of: "Original Alameda 36-inch pipe line," the length of this original Alameda 36-inch pipe line, as constructed about 1887-8, was 144,135 feet, and contained 10,067,000 pounds of plate-iron.

The portion laid on the trestles, of a total length of 18,960 feet, was the same in both the original and the present line.

As shown in Table III, according to Mr. Reynolds' testimony, the direct charges to the original construction of the original 36-inch Alameda line amounted to $1,586,869.30.

These total direct cost charges to the original construction of the 36-inch Alameda pipe line have been fully discussed in this brief under the head of: "Original Alameda 36-inch pipe line"; which discussion appears preceding Table IV. As there shown we assumed as the result of this discussion that complainant's accounting department had included in the above total of $1,586,869.30 the cost of construction of special structures on this original line, consisting of the Niles aqueduct, the long trestles across the marsh on both sides of the bay; the original double 16-inch submarine pipe line, with its shore connections; and the 36-inch connection gate at Burlingame; all of which separate structures were built at the same time (in 1887-8) with the construction of the original 144,135 feet of 36-inch Alameda pipe line.

In the absence of separate original cost figures for these special structures, their cost of reproduction (exclusive of incidentals, etc.), as estimated by Mr. Schussler for 1903-04 (pp. 1136-1139, 1165-6-7, and 1178) amounting to a total of $290,400.00, was deducted from the total direct cost charges of $1,586,869.30 made to this line, by complainant's accounting department (Table III). This deduction left a balance of $1,296,469.30, or, in round figures, $1,296,000.00, which would represent the direct charges to the construction of the original 144,135 feet of the Alameda pipe line, and does not include any charge for Niles aqueduct; for the double 16-inch submarine pipe, etc.; for trestles across the bay marshes; and for the 36-inch gate at Burlingame.

As shown in Table IV, the 144,135 feet of original 36-inch Alameda pipe line contained 10,067,000 pounds of plate-iron; while the present 36-inch Alameda pipe line has a length of 143,150 feet, and contains 10,028,000 pounds of plate-iron (Test. p. 1164). The relation between the original and present weight is therefore as 10,000 to 9,961.

If, therefore, the above net total of direct cost charges, due to the 144,135 feet of original pipe line of $1,296,000, is reduced in the proportion of 9,961/10,000 we obtain $1,290,945.60, or, in round figures, $1,290,945.00, as the proportion of direct cost charges due to the construction of the present lengths of the 36-inch Alameda pipe line.

For the present 36-inch Alameda pipe line, we therefore have the following comparative results:

Mr. Schussler's estimate of present cost of reproduction of the present 36-inch Alameda pipe line (exclusive of 10 per cent for incidental, etc., expenses):	Direct charges to the original cost of construction as deduced from Mr. Reynolds' testimony as above shown, of the present 36-inch Alameda pipe line:
$1,033,970.00	$1,290,945.00

E.

54-Inch Alameda Pipe Line.

In Mr. Schussler's estimate of what it will cost, in 1903-04, to reproduce the new 54-inch Alameda pipe line, he gives the length of this pipe at 16,758 feet, the weight of plate-iron contained therein at 3,005,000 pounds, and his cost estimate of reproduction, based upon his average estimate of 10.60 cents per pound for all complainant's pipe lines (but not including extra

connections on this pipe line, nor 10 per cent for incidentals, etc.), as $318,530.00.

Mr. Reynolds' testimony (Table III) gives the direct cost charges made to this pipe line as $347,201.99.

As shown herein, just preceding Table IV, it does not appear in Mr. Reynolds' testimony whether the cost of a system of connecting pipes and gates, placed at both ends of this pipe line, and estimated by Mr. Schussler on page 1203 of his testimony at $7,670.00, has been included by Mr. Reynolds in his above total of $347,201.99. Assuming that the above item for connections was included in the latter total, we would have, by deducting it from this total, $347,207.99, less $7,670.00, or $339,531.99, as the direct cost charges made by complainant's accounting department to the new 54-inch Alameda pipe line.

A comparison of this cost charge by complainant's accounting department of $339,531.99, for the 54-inch pipe line (without the connections above referred to)—with Mr. Schussler's estimate for the same pipe (without the same connections) of $318,530.00 (the latter estimate being based upon his average cost figure per pound of plate-iron of 10.60 cents, adopted by him for all of complainant's pipe lines), shows that, although in this one recent case of the 54-inch Alameda pipe Mr. Schussler knew that the actual cost of this pipe considerably exceeded his estimate of cost of reproduction, still, having, in all his pipe estimates, adopted the standard average cost figure for all of complainant's pipes, of 10.60 cents per pound of plate-iron, he applied this same average figure in the case of the new Alameda pipe line, although it resulted in a lower estimated cost of reproduction than its actual known cost of construction.

For the new 54-inch Alameda pipe line, we therefore have the following comparative results:

Mr. Schussler's estimate of present cost of reproduction, based upon his average cost for all of the pipe lines of 10.60 cents per pound of plate-iron (exclusive of special structures and of 10 per cent for incidental, etc., expenses):	Direct charges to the original cost of construction of the new 54-inch Alameda pipe line (exclusive of special structures) as deduced from Mr. Reynolds' testimony, as above shown:
$318,530.00.	$339,531.99.

The following Table No. XIV contains a recapitulation of the above results, sub. A, B, C, D and E, and furnishes a comparison between Mr. Schussler's estimates of cost of reconstructing, in 1903-04, the pipe portion of complainant's above pipe lines, with the direct cost charges for their original construction, as deduced from Mr. Reynolds' testimony from complainant's records.

The result of the above analysis of complainant's wrought iron pipes, including the various tables ending with the final comparative Table XIV, shows that Mr. Schussler was justified in his belief that the direct

TABLE XIV

Name of *Present* Wrought-Iron Pipe-Lines	Diameter in Inches	Lengths in Feet		Weight of Plate-Iron in Pounds	Mr. Schussler's estimated cost of reproduction in 1903-04 of the pipe-lines (exclusive of special structures and incidental, etc., expenses), *based upon his average estimate of* 10.6 *cents per pound of plate-iron*, for pipe complete in the trench, and 8.6 *cents per pound*, on trestles.	Direct charges of the original cost of construction of the pipe-lines, exclusive of special structures, as deduced from Mr. Reynolds' testimony. (See Tables II and III).
		Separate Lengths	Total Lengths			
a Pilarcitos pipe-line.....	30″ 22″	65,170′ 2,400′	67,570′	2,823,800 (pp. 785-6)	$299,323.00 (pp.758-6)	$386,257.05
b San Andreas pipe-line.....	44″ 37″ 30″	28,830′ 1,400′ 39,300′	69,530′	5,393,000 (p. 869)	571,658.00 (p.870)	524,600.00
c Crystal Springs pipe-line.....	44″	87,260′	87,260′	8,655,000 (p. 986)	903,743.00 (p.989)	863,600.00
d Alameda 36-inch pipe-line.....	36″	143,150′	143,150′	10,028,000 (p. 1164)	1,033,970.00 (p.1165)	1,290,945.00
e New Alameda 54-inch pipe-line.	54″	16,758′	16,758′	3,005,000 (p. 1202)	318,530.00 (p.1202)	339,531.99
			Totals	29,904,800 lbs.	$3,127,224.00	$3,404,934.04
				Average per pound of plate-iron	10 457/1000 cents	11 385/1000 cents

The result of the above analysis of complainant's wrought iron pipes, including the various tables ending with the final comparative Table XIV, shows that Mr. Schussler was justified in his belief that the direct cost charges, as made by complainant's accounting department to the various structures, did not in many cases represent their full actual cost, and that Mr. Schussler's estimate of the total cost of present reproduction of complainant's wrought-iron pipe lines is not higher than the cost of their original construction, but, on the contrary, is lower than their original cost, as shown by Mr. Reynolds' testimony.

Counsel for defendant, throughout their brief, practically ask the court to accept and adopt the estimates of their witness, Mr. Dockweiler, which were given in the lump. Mr. Dockweiler is strangely silent regarding detailed data of his own on the cost or value of any of these pipe lines by which it might have been shown how he arrived at his opinion as to their present value. The efforts of counsel in their brief are therefore directed largely to an attempt to depreciate the force of the detailed estimates of Mr. Schussler.

Mr. Dockweiler, besides being defendants' witness in this case, shows, on the face of his exhibits (Defendants' Exhibit 90) that he is officially connected with the city as one of its employees. On that exhibit, which relates to "Composite Dam Sections," there appears the following inscription:

> "Prepared under the direction of J. H. Dockweiler, Consulting Engineer to Percy V. Long, City and County Attorney of San Francisco, Nov., 1905."

Mr. Dockweiler does not even attempt to prove any of his statements, conclusions or deductions. He simply states his estimates of values in the lump:

"Pilarcitos system .....$ 594,293
San Andres system 898,080
Crystal Springs system 1,918,667
Alameda Creek system ..... 2,025,324"

(Defendants' Test., p. 647), which figures embrace his views as to the cost or value of the works on each of the above four systems, including not only the wrought-iron pipe lines, but also all dams, tunnels, gates, flumes, aqueducts, trestles, submarine pipes, etc. He gives no detailed figures either as to the pipe lines, or as to any of the separate structures contained within each of the above four systems or groups.

XIV.

Cost of the Brickwork.

Reply to the Contentions of Counsel for Defendants as to the Estimates on This Portion of the Work.

Brickwork having been used by complainant in various portions of its present works, Mr. Schussler has made his estimates of what the brickwork would cost under the present conditions of cost of materials, and of labor, as actually now performed.

On page 429 of their brief, counsel for defendants, claiming that the testimony of certain witnesses quoted by them shows that Mr. Schussler has placed exaggerated values on this portion of the work in the various structures, say:

"Mr Schussler's figures and statements on brick work having been shown to be so entirely at variance with the facts disclosed by the testimony of Messrs.

Higgins and Carey, we deem it advisable at this point to give a short resume of this section of the work."

In this so-called resume they not only attack Mr. Schussler's testimony as to the cost of the work, but they endeavor to show that the work itself was of inferior character.

Therefore, before examining the testimony as to the cost of the brick work, a few words as to its general character will not be out of place:

Character of the Brick Work.

Mr. Schussler testifies (p. 839):

Q. 1099: "I noticed you used the word that in laying the brick you laid them with first-class joints, handling each individual brick. Can you give a little description and state the reason why?"

A. "What I stated was, treating each individual brick as an individual. Our work is of such great importance and it is subjected to such strains and such severe tests that we cannot afford to do poor work or cheap work. It is not a question with us how many brick can a man lay in a day, but how many brick can a first-class man lay well and thoroughly, so that each brick cannot be laid any better. That always means without any waste of time whatsoever. If a man tries in that very important and responsible work to lay brick like for instance they do in the general work in the San Francisco sewers, or the general brick work in buildings in San Francisco, that man would be at once discharged, because he could not possibly devote the care and attention to that work that is demanded on account of the importance of the work. Therefore we not only selected and picked out the very best and most skilled bricklayers we can find, and reliable men, but we also select the very best brick that we can find; we are very particular about the quality of our

cement, of the sand and of the proper mixture of the mortar, and that the brick are thoroughly saturated with water, so that in being put in they do not absorb the moisture out of the mortar too quickly, thereby making an apparently rapid setting, but which afterwards injures the strength of the work. In that way we compel every man who works for us to do his work thoroughly well. There is no better brick work anywhere in the world than the brick work we are doing, and still, for the character of the work that we do, it is cheap because no piece of brickwork that we have ever done has ever given out on us or has ever required any repair."

Q. 1100 "As an hydraulic engineer do you consider this system of laying brick justified and proper and not extravagant?"

A. "It is. It is the only way that work can be done to be done properly."

As an illustration of the care exercised by complainant in selecting the bricks used in its structures, as well as in cement and sand, and in the workmanship employed in its brickwork, the tapping, under a great water pressure, of the 26-inch brick wall of the large deep outlet well of the San Andres Reservoir, which formed the inlet of the Bald Hill Tunnel, is here quoted from Mr. Schussler's testimony. The pictures hereinafter referred to are contained in Complainants' Exhibit 27, which was filed in this suit.

Mr. Schussler says: (p. 858)

"In picture No. 19 is shown the windlass on the large brick shaft, and also the caisson which I built for the purpose of cutting through the wall of the brick forebay and connecting it with the bottom of the concrete forebay, the 3-compartment forebay. The caisson was made of heavy timber and it was rubber-faced. The detail is shown on picture No. 19, showing the soft rubber edge, while on picture 20,

the back is shown with a vertical 8-inch pipe acting like the handle on a large spoon. This caisson was lowered down into deep water, into the brick forebay, and exactly in place opposite to where the wall was to be tapped by the tunnel that was drifted from the 3-compartment tunnel*. This caisson was lowered into place in front of this place where the connection was to be broken through. This connecting tunnel, marked C and D on 'Complainants' Exhibit 40,' had to be very carefully drifted, as we did not know how the ground would act. I knew one thing, that the brick work of the original forebay was absolutely sound, that I could go right up to it and cut it out and the brick work would not give out on us under this immense water pressure that was in this forebay at the time. The connecting tunnel was thoroughly bricked—sides, bottom and top—as shown by a flash-light picture on page 20, photograph No. 28, in 'Complainants' Exhibit No. 27.' After the caisson had been placed exactly in the right place, a drill hole was driven through from this tunnel C and D—through the wall—making a rush of water from the main shaft towards the empty one we were working in, and the water pressure forced the caisson with its soft rubber edging up against the brick work closed it absolutely tight, and thereafter we cut out the brick work by cutting through this 26-inch brick wall. This picture No. 28 on page 20 of 'Complainants' Exhibit No. 27' shows the inside of this connecting tunnel and also shows the inside view, showing the back of the caisson after the hole had been cut through the old brick wall, which showed to me, more than anything I have done, the superiority of our brick work.

"Unless it had been of the most marvelous quality as regards hard brick and first-class cement joints, and well laid and all the joints filled, we could never have done this work; it would have been apt to give out on us. You must excuse this digression, but it

* Shaft, instead of tunnel.

was necessary to show how well all and every part of our brick work was done."

The four important items included in complainants' brick work are sand, cement, brick and labor. We will discuss those items and the testimony as to their cost, etc., in the order in which they are here mentioned.

SAND.

The Cost of This Item in the Brick Work as Shown by the Testimony.

One of the contributing elements to the cost of materials to be used in the brick work, if it were to be constructed in 1903-04, consists in the difficulty and cost of obtaining at this present time, the large quantities of suitable sand needed for this brick work, as shown in the testimony.

In reference to the work at Pilarcitos, Mr. Schussler says: (Complts. Test., p. 753)

> "There is no sand fit for brick work in that portion of San Mateo County. *All our sand has to come from San Francisco County.* It is delivered in barges at San Mateo wharf, or, in this case, at Millbrae wharf whenever that is in order, at the cost of $1.60 per cubic yard."

In other words, whatever might have been the case years ago when that part of the work was constructed, there were no longer in 1903-04 available deposits of sand of suitable quality in the neighborhood of the works.

Mr. Carey, who, as we have seen, states that many years ago, while working for complainant, he "did most everything," "drove a mule-team" and "dipped some pipe," also says that while acting as teamster for

complainants, he hauled some sand for some of the brick work, then in course of construction. Regarding the location from which he obtained the sand, he says:

> "I hauled sand for the Bald Hill tunnel and got the sand in the ravine near Millbrae, about one and a half or two miles from there." (Defendants' Test., p. 45).
>
> * * *
>
> "All the sand I hauled I got this side of the county road, about 600 feet this side of the 17-mile house, where it stood at that time. I got the sand in the willows there. The water used to run through there and gather all the sand against the willows. The water company had a man there screening and saving it." (pp. 45-6).

It is very evident that the sand which *one man* could save and screen from among the willows of a small stream could not form a very large proportion of the quantity used in works of this magnitude, and Mr. Carey's statement that the water "used to run" there and collect the sand implies that that condition has ceased to exist.

Defendants' next witness, regarding the location where sand was obtained for the building of the Pilarcitos waste-weir which, as shown on Table II, was built in the latter part of the sixties, was Mr. Fifield, who says:

> "I also hauled sand for the company when the Pilarcitos waste-weir was being built. I received $10 a day, supplied a four-mule team, boarded myself and took care of my animals. At first the sand used in that work was gathered from the Pilarcitos Creek, but *when that gave out,* the company employed me to haul sand from the creeks at Millbrae. They *had a man there* gathering sand from the creek beds and sifting it." (p. 48)

This goes to show merely that *at that time* enough sand for the purpose of the specified brick work then being constructed was gathered near Millbrae.

Mr. Higgins, in his testimony regarding the sand used in the brickwork of Bald Hill Tunnel, which was bricked about the year 1870, says:

> "The sand was hauled from Millbrae. It was gathered from out of the creek beds in that vicinity." * * * 'The sand was gathered from the creek beds and the only cost was for hauling." (pp. 5, 6).

It will be noticed that, in his testimony, Mr. Higgins omits to include in his cost estimate the additional cost of labor at that time, admitted by both Mr. Carey and Mr. Fifield to have been required for *saving* the sand and *screening* it, before hauling.

None of the witnesses testify that the sources from which sand was then obtained are now available, and Mr. Schussler's testimony, above quoted, shows affirmatively that they are not and that as a consequence, complainant was compelled by the present absence of suitable sand in that region, for use in its later works, to select the next nearest and most available source, which was San Francisco County. For the purpose of estimating what it would cost in 1903-04 to construct the brick work of complainant, he therefore based his estimate of the item of sand on that source of supply.

As regards the quality and probable quantity of sand *at that time* available for complainant's purposes, both Mr. Carey and Mr. Fifield say complainant "had a man there" gathering sand from the creek beds and "saving" and sifting or "screening" it, not only confirming Mr. Schussler's testimony as to the care exercised in securing sand of suitable quality, but also showing that even at that time the deposits were com-

paratively small in quantity, as the sand had to be "saved" while being washed down the creek in order to obtain a sufficient quantity.

Mr. Schussler says again, when asked why he speaks of getting sand from San Francisco:

> A. "Because that is the nearest place that we can get good, absolutely clean sand, without any admixture of loam. We must have sharp angular sand, perfectly clean and free from any and all impurities to make the perfect work we are doing." (p. 841)

This testimony is practically confirmed, as we have seen by defendants' witnesses.

The Testimony of Defendants' Witnesses as to the Cost of Sand Analyzed.

The cost of sand delivered in 1903-04 at the various structures, as estimated by Mr. Schussler in his testimony, is hereinafter set forth, as are also the estimates of what, according to *defendants' witnesses,* Mr. Fifield and Mr. Carey, it appears to have cost in past years, when this brick work was constructed.

For the brick waste-weir, at the Pilarcitos Dam, Mr. Schussler, in giving his estimate as to cost of construction in 1903-04 (which includes the cost of transportation of the sand from San Francisco to Millbrae wharf), says: (pp. 753-4)

> "It is delivered in barges at San Mateo wharf, or, in this case, at Millbrae wharf, whenever that is in order, at the cost of $1.60 per cubic yard. A 4-horse team hauls 2 cubic yards to a load and makes one round trip to Pilarcitos and back. The two cubic yards costing at Millbrae or San Mateo $1.60 a yard, makes a total of $3.20. Adding to this the hauling of the two cubic yards to Pilarcitos, $7.50, it makes the cost of the two cubic yards of sand, deliv-

ered at Pilarcitos dam, $10.70. The 2 cubic yards of sand represent 14 barrels of sand. Dividing $10.70, the cost of 2 cubic yards, by 14, it gives 76 cents per barrel of sand delivered at Pilarcitos. As we use 5 barrels of sand for each 1,000 bricks laid, the sand necessary for 1,000 bricks laid is equal to 76 times 5, or $3.80 cents."

MR. FIFIELD'S TESTIMONY SHOWS A COST GREATER THAN MR. SCHUSSLER'S ESTIMATE.

Defendants' witness, Mr. Fifield, according to his testimony before quoted, hauled sand for this Pilarcitos waste-weir, which was originally constructed in the sixties. (Table II.) He says he was paid $10 a day, supplied a four-mule team, boarded himself and took care of his animals, and he adds:

"I would load my wagon with 10 barrels and sometimes 12 barrels of that sand, and haul it to the Pilarcitos waste-weir. I made one trip a day" (p. 48).

Averaging these 10 and 12 barrels at 11 barrels to a load, shows that he was paid 90 cents per barrel of sand delivered at Pilarcitos. This cost of 90 cents per barrel would be *exclusive* of the extra *cost* which complainant paid for labor employed in gathering the sand from the creek beds near Millbrae and sifting (or screening) it. Compared with the actual cost of 90 cents testified to by Mr. Fifield for hauling alone, Mr. Schussler's estimate for 1903-04 of 76 cents per barrel, including the cost of the sand and hauling and delivering at Pilarcitos Dam is very conservative.

Defendants' witnesses do not state how many barrels of sand one man, at the wages then ruling of $2.00 for a day's work of 10 hours, could save, gather and screen at Millbrae in a day.

Mr. Carey, in his testimony *on sand,* says: "The men who screened the sand would help me to load."

(p. 46.) From this it may be inferred that the sand was screened at about the ratio at which it was being hauled away.

Judging from the amount of screened sand that Mr. Fifield hauled away daily from Millbrae, it would appear that if the extra *cost* of labor employed by complainant in saving, gathering and screening the sand and, at times, assisting in loading the same on the wagons, were added to Mr. Fifield's cost of 90 cents a barrel for hauling, the total cost, delivered at Pilarcitos Dam would reach, if not exceed, $1.00 per barrel, which is fully 30 per cent more than Mr. Schussler's estimate of 76 cents.

The testimony of the other witness for defendants, Mr. Carey, regarding the hauling of sand from Millbrae to Pilarcitos gatehouse (which is near the Pilarcitos Dam, as shown on Complainant's Exhibit 21) is vague in its character. He says when asked how much he carried to a load:

> "Two or three yards. I put in side boards and tail boards and filled the wagon up about 16 inches high. The wagon was about four feet wide. I always used six mules." (p. 45)

Mr. Carey, while mentioning four feet as the width of the wagon, does not give its length. Mr. Schussler states that over the road to Pilarcitos a four-horse team can now haul two cubic yards of sand as a day's work; and defendants' witness, Mr. Fifield, from his experience, places the day's work of a four-mule team at from ten to twelve barrels to a load a day, or an average of 1 57-100 cubic yards, (one barrel of sand, as shown in Mr. Schussler's testimony, constituting at that time one-seventh of a cubic yard.)

Mr. Schussler's testimony (pp. 753-4) above quoted, states that now, or under the present conditions of the road from Millbrae to Pilarcitos a four-horse team can haul 2 cubic yards or 14 barrels and make one round trip a day, instead of Mr. Fifield's ten and sometimes 12, or an average of 11 barrels, indicates an improvement in the present condition of the road that allows an increase of the load by fully 25 per cent.

Mr. Carey says that he made one round trip a day from Millbrae to Pilarcitos, where they were putting in a new gate-house at the inlet of No. 1 tunnel, and that his load for a six-mule team consisted of "two or three yards." (p. 45.) Two or three yards is indefinite, but we may assume that with the six-mule team he could haul an average between the two figures of 2½ cubic yards. Mr. Carey does not state what was the *average cost or value* of a day's work of the six-mule team which he drove, including the wages of the driver and the cost of maintenance of the latter and of the team, harness and wagon. As no doubt the cost of the day's work of a six-mule team, complete, was greater than that of a four-mule or four-horse team, it is probable that, from the point of cost, the greater load of the six-mule team, compared with that of a four-mule team, was practically offset by the greater cost of the former over that of the latter.

Neither Mr. Fifield nor Mr. Carey say anything as to the weight of the load their respective teams could haul.

On this subject Mr. Schussler's testimony as to the hauling of brick supplies some data. He says: (p. 752)

"Hauling this brick from Millbrae station to Pilarcitos, a 4-horse team makes one round trip a day,

hauling about 2½ tons over these steep mountains, or, in round numbers, about 1000 brick per load."

This places the load which a four-horse team can haul at about 5,000 pounds. He also says that a four-horse team can *now* haul over the present road two cubic yards of sand to a load, and make one round trip a day; which would make the weight of a cubic yard of sand 2,500 pounds.

Mr. Fifield's average load of 1.57 cubic yards of sand would therefore weigh 3,925, or in round figures, 4,000 pounds.

Mr. Carey's daily load of "2 *or* 3 cubic yards of sand," which we have *averaged* at 2½ cubic yards, would weigh 6,250 pounds for the *six-mule team.*

The above showing as to the respective loads which Mr. Fifield could haul from Millbrae to Pilarcitos with his *four-mule team,* and which Mr. Carey could haul with complainant's *six-mule team,* when compared with a load for a *four-horse team,* upon which Mr. Schussler bases his estimate of *present cost,* shows that Mr. Schussler's estimate based on a load of 5,000 pounds hauled by a four-horse team, at a standard cost of only $7.50 per day (including wages and board of driver and maintenance of horses, harness and wagon) is *low* and *very conservative.*

ESTIMATES FOR SAND IN THE VARIOUS STRUCTURES.

A.

The Sand in the Pilarcitos Brick Work.

The various brick structures of complainant, contained within what is known as the *Pilarcitos region,* the brick work of which was constructed more than

thirty years ago, under conditions of cost and performance of labor then existing, are as follows:

a. (Complainant's Test., pp. 750 to 755): Waste-weir at Pilarcitos Dam;

b. (pp. 762 to 766): Brick portion of gate-house at inlet of Pilarcitos tunnel No. 1;

c. (pp. 770 to 773): Pilarcitos tunnels No. 1 and No. 2;

d. (p. 1012): Small brick work cap on top of Lower Pilarcitos stone dam;

e. (pp. 1017 to 1019): Lock's Creek tunnel No. 1.

For items *a, b, c* and *d* Mr. Schussler, in his estimate of cost of reconstructing this work in 1903-04, and under the conditions prevailing at this time regarding the present cost of delivering suitable sand to these four structures, has adopted as an average cost figure for sand delivered, the same standard, as above shown, for the Pilarcitos waste-weir, of 76 cents per barrel of sand, which, at the rate of five barrels of sand used per each 1,000 bricks laid, makes $3.80 cents for the sand used for each 1,000 bricks laid.

The haul of sand from Millbrae has practically the same length for *a, b* and *c,* while that for *d* is fully two miles further than Pilarcitos dam, as shown on complainant's Exhibit No. 21.

For item *e,* which represents *Lock's Creek Tunnel No.* 1, the present cost of transporting sand to both ends of this tunnel, owing to the greater length of haul from Millbrae (Complainant's Exhibit No. 21) than to Pilarcitos dam, and owing to the necessity of re-handling (for present reconstruction) of the sand and all other materials, from the top of the ridge above the tunnel, down to both ends of the same (Test. pp. 1018

and 1019), has been estimated by Mr. Schussler at $4.42 for the sand per 1,000 bricks laid in this tunnel. (p. 1019)

This figure represents (at five barrels of sand per 1,000 bricks) a cost of 88.40 cents per barrel of sand delivered at the respective ends of the tunnel, against Mr. Schussler's present cost estimate for the *other* four brick structures *a, b, c* and *d* in the Pilarcitos region of $3.80 for the sand per 1,000 brick, which latter figure equals 76 cents per barrel of sand, delivered at the latter four works, *a, b, c* and *d*.

The following are quotations from Mr. Carey's testimony regarding the hauling of the sand for Lock's Creek tunnel No. 1 to the westerly or *inlet* end (see No. 38 on Complainant's Exhibit No. 21), which is located on the easterly slope of the *lower Pilarcitos Valley* and about 2½ miles down stream from the Pilarcitos main dam, while its easterly or *outlet* end is located on the westerly slope of San Mateo Valley, and, as shown on complainant's Exhibit No. 22, more than two hundred feet above the level of San Mateo Valley, which valley now forms a part of the bottom of the present Crystal Springs Reservoir.

Q. 30: "Did you haul sand to any other tunnels besides the Bald Hill tunnel?"

A. "Yes, sir, I hauled sand to the Lock's Creek tunnel."

Q. 31: "How many trips did you make?"

A. "Only one trip."

Q. 32: "How many trips did you make when you went to the outlet end?"

A. "I made two trips. When I went to the inlet end I had to go into the San Mateo Valley and could only make one trip."

Q. 33. "Did you haul away sand to Pilarcitos Valley?"

A. "I hauled sand there when they put in the new gate-house at the inlet of the No. 1 tunnel. I hauled the sand from Millbrae and made one trip a day, and then I would put on a load of wood and take it back to San Andres. I hauled the sand used on the Lock's Creek tunnel. All the sand I hauled I got this side of the County Road, about 600 feet from the 17-mile house, where it stood at that time." (Defendants' Test. p. 45.)

The unreliability of Mr. Carey's memory, relating to his hauling sand from Millbrae to the *inlet* and *outlet* ends respectively of Lock's Creek tunnel No. 1, *fully thirty years prior* to his giving this testimony, is shown by the fact according to his testimony when he hauled sand from Millbrae to the *inlet* end of Lock's Creek tunnel (which, as shown on the above Exhibit No. 21, is located in the *lower Pilarcitos Valley*), he "had to go into the San Mateo Valley and could only make one trip" (a day). As above shown, the end of the tunnel, to which he refers, and to which he could make only *one trip a day* with a load of sand from Millbrae, is *the outlet* end of the tunnel and *not the inlet,* as he calls it.

In his answer to question No. 32, on page 45, regarding the number of trips he could make in a day, hauling sand from Millbrae to the *outlet end* of the same tunnel, he says: "I made two trips." In his previous testimony, relating to the hauling of sand from Millbrae to the *Bald Hill tunnel* (which, as shown on complainant's Exhibit No. 21, is located between Nos. 26 and 27, and within a few miles only of Millbrae)—he says:

"I hauled sand for the Bald Hill tunnel and got the sand in a ravine near Millbrae, about one and a half or two miles from there."

Q. 29: "How many trips a day did you make?"

A. "I made two trips a day to the Bald Hill tunnel." (p. 45).

By referring to complainant's Exhibit No. 21, it will be seen that on this exhibit the numbers 26-27 represent the *Bald Hill tunnel,* located about two miles from Millbrae, and numbers 38-39 represent the *outlet of Lock's Creek tunnel No.* 1. Following the more direct route, which Mr. Carey's team could then take, from Millbrae over Bald Hill, down the San Andres and Crystal Springs valleys into and up the San Mateo valley and up a grade on the westerly slope of the latter valley, to the *outlet* of Lock's Creek tunnel No. 1, the distance from Millbrae (as measured on complainant's Exhibit No. 21), is fully seven miles. This distance does not include any additional length made up by the curves and bends in this road.

Mr. Carey's testimony relating to Bald Hill tunnel is that he could make *two round trips* in a day from Millbrae to Bald Hill tunnel, each round trip having a length of about four miles, so that according to his statement he made for two round trips a total distance of about 8 *miles a day,* having to climb, with his six-mule team, over Bald Hill, with his full load, *twice a day.*

Complainant's Exhibit No. 21 shows that the distance he would have to traverse with his load from Millbrae *over Bald Hill* and finally up the grade to the tunnel outlet, is fully 7 miles. One round trip, therefore, would be fully 14 miles.

Comparing this *one* round trip, to and from the Lock's Creek tunnel outlet of 14 miles, with his *two*

round trips, to and from Bald Hill tunnel, of 8 miles, which he calls *a day's work* for the six-mule team, his statement that he made two trips a day hauling sand from Millbrae to Lock's Creek tunnel outlet, seems incredible.

Furthermore, as *one round trip* from Millbrae to the Lock's Creek tunnel outlet covers a distance of fully 14 miles, two such round trips a day would represent fully 28 miles as a day's work for one team, or fully 20 *miles more* in a day than for the two round trips, or 8 miles, which Mr. Carey called *a day's work* for hauling sand from Millbrae to the Bald Hill tunnel.

Regarding the hauling of sand and other materials required for the bricking of the *westerly* portion of Lock's Creek tunnel No. 1, which was accomplished from the *inlet,* or westerly end, of the same, Mr. Schussler, in his estimate of what it would cost per thousand bricks to reconstruct this tunnel under the conditions prevailing in 1903-04, says: (Test. pp. 1018-19)

> "The handling, loading and unloading, and the hauling of this brick to this place, to both ends of the tunnel, which required reloading them into sleds on top of the hill and sledding them down to the inlet of the tunnel, that is, to the westerly end, and including loading at Millbrae and unloading at the tunnel, cost, per 1,000 brick.....$10.33
>
> "The cement, per thousand brick, including the cost of purchase, transportation by rail, hauling it over the hill and sledding it down to the tunnel inlet $8.76
>
> "Sand delivered at the tunnel inlet and outlet .....$4.42"

These quotations from Mr. Schussler's testimony show that at the time of the original construction of the tunnel, more than thirty years ago, the *brick, cement* and *sand* required and used for the bricking

of the *westerly* or *inlet* portion of this tunnel, were hauled to the top of the ridge, which is pierced by Lock's Creek tunnel No. 1, and were there unloaded; and that these materials, from this point, were here rehandled, loaded on to sleds and were sledded down the hill to the tunnel inlet and there deposited. It furthermore shows that owing to this extra handling and sledding down of these materials *to the tunnel inlet,* an extra cost was caused over the cost of the same classes of materials hauled to the *Pilarcitos region,* to the structures above mentioned under the heads of *a, b, c* and *d,* which latter four structures, owing to their greater accessibility, did not require such extra handling and sledding.

This method of hauling and handling was justified by the fact that, *at the time,* when the tunnel was being originally constructed, the wagon road leading down the valley from Pilarcitos Reservoir, terminated, as it does now, at the northerly end of the reservoir formed by the lower Pilarcitos stone dam. As a long, crooked and expensive piece of wagon road would have had to be constructed to the tunnel inlet, from the above former and present terminus of this old Pilarcitos road, near the head of the stone dam reservoir, it was then a measure of economy to haul the materials for *the inlet portion* of the Lock's Creek tunnel to the top of the ridge and sled them down to the inlet end. As has been shown in Mr. Schussler's testimony, since the original construction of Lock's Creek tunnel No. 1, the large concrete Crystal Springs dam has been constructed, submerging the wagon road formerly existing along the bottom of Crystal Springs Valley and up the San Mateo branch of the same, over which road the brick, cement and sand, required for the outlet portion of Lock's Creek tunnel No. 1, were hauled. This fact

as well as the absence of a wagon road, both in the past and at present, leading to the tunnel inlet, accounts for the fact that Mr. Schussler, in his estimate of cost of reconstruction in 1903-04, for handling materials under present circumstances to both ends of Lock's Creek tunnel No. 1, adopts, as a measure of economy, the same method of hauling all the materials to the top of the ridge and sledding them down to both ends of the tunnel, as was adopted during the original construction, in reference to the inlet end only.

This fact is overlooked by defendants' counsel when they say in their brief (p. 411):

> "The foregoing testimony of Mr. Carey would seem to show that Mr. Schussler was mistaken in stating that it was necessary to reload the bricks into sleds on top of the hill and sled them down to the inlet of the tunnel (pp. 1018-19)."

In his estimates on the present cost of reconstruction of the small brick cap on top of the Lower Pilarcitos stone dam (which is itemized in the above five brick structures, a, b, c, d and e, in the Pilarcitos region), Mr. Schussler does not go into detail regarding the cost of the sand delivered at this dam, although the latter is located several miles beyond the Pilarcitos brick waste-weir (item *a*), thus requiring a longer haul. Mr. Schussler, in his estimate, adopts for the brick work on this dam the same present cost per 1,000 bricks laid as he does for the shorter haul to Pilarcitos waste-weir of $56 per thousand bricks laid complete. From this it can be inferred that he does not make an allowance for additional cost of hauling the material, such as sand, cement and brick, to the greater distance required for the lower Pilarcitos stone dam.

In what has been said above regarding sand, it has been shown that the present cost of the sand, delivered to the five brick structures in the Pilarcitos region, heretofore designated as a, b, c, d and e, as estimated by Mr. Schussler in his testimony, is low and conservative, and not high and excessive, as counsel for defendants attempt to show by deductions from the testimony of defendants' witnesses, and, particularly from that of Mr. Carey, whose testimony appears to be based largely upon a faulty memory.

A recapitulation of what has here been said regarding the sand required for the five brick-work structures in the Pilarcitos region, to which the above showing relates, giving Mr. Schussler's respective estimates of cost, in 1903-04, of delivering suitable sand from San Francisco to the same, per barrel and per thousand bricks laid, is as follows:

Name of Structure:	Mr. Schussler's estimate of cost for 1903-04, of sand delivered at the respective structures:	
	Cost of sand per barrel delivered	Cost of sand per 1,000 bricks
a. Waste-weir at Pilarcitos dam	76 cents	$3.80
b. Gate-house at inlet of Pilarcitos tunnel, No. 1	76 cents	3.80
c. Pilarcitos tunnels No. 1 and No. 2	76 cents	3.80
d. Brick cap on top of lower Pilarcitos stone dam	76 cents	3.80
e. Lock's Creek Tunnel No. 1	88.4 cents	4.42

B.

Sand for the Group of Brick Work in the San Andres Region.

The three brick structures, contained within what is known as the San Andres region, were built in and prior to 1874-5, with the exception of the subsequent continuation of the San Andres waste-weir tunnel, which was added to the original tunnel a number of years later. These three structures are:

f. Large brick shaft and brick tunnel leading into it from the San Andres reservoir (complainant's Exhibit No. 40); Mr. Schussler's testimony (pp. 844-5-6);

g. Brick work tunnel, commonly known as Bald Hill Tunnel, 2,820 feet in length (complainant's Exhibit No. 40. Test. pp. 846 and 863-4-5);

h. Brick work waste-weir, near San Andres dam, consisting of the original waste-weir and the portion added subsequently (complainant's Exhibit No. 39, and Test. pp. 819 to 827).

f. The Sand for Large Brick-work Shaft and Tunnel Connecting With the San Andres Reservoir.

That the sand (as well as the brick, cement and workmanship) used in the original construction of all these parts of the work, done by complainant by day's work, was suitable, properly selected and of first-class quality, is fully shown in the testimony (pp. 858-9).

Mr. Carey says he hauled this sand also (p. 46).

As heretofore shown, the "two or three yards" of sand to the load, which Mr. Carey could haul with a six-mule team, amounted to a net weight of sand hauled

of 6,250 pounds; and as one cubic yard of sand equals seven barrels, his average load of sand for a six-mule team amounted to 17½ barrels of sand.

Mr. Carey does not give the cost or value of a day's work of the six-mule team of complainant, which he drove, nor does he give the cost of repair and maintenance of harness and wagon, nor the cost of horse feed, shoeing and wear and tear; nor does he give the additional cost of labor, required to save, gather, select and screen the sand near Millbrae. His wages as teamster, while working for complainant, driving the latter's six-mule team, he gives as $70 a month and board. For 26 working days in the month, Mr. Carey's daily pay would therefore amount in round figures to $2.70 per day, plus his board, which may be assumed at an average of eighty cents a day for each working day, making his total pay $3.50 a day.

As Mr. Carey's testimony is silent on all the other cost items, above enumerated, of a day's work of hauling sand from Millbrae to Bald Hill tunnel or to the San Andres waste-weir, with the six-mule team, his testimony as to the cost per cubic yard or per barrel of sand, so delivered, is of no value.

The only testimony produced by defendants as to the cost or value of a day's work of a four-mule team, by which sand was hauled from Millbrae, is that of Mr. Fifield, that he received $10 a day, supplied a four-mule team, boarded himself and took care of his animals; but this does not include the additional cost to complainant of saving, gathering and screening the sand prior to hauling it away.

Mr. Carey states that to Bald Hill tunnel he could make two loads a day with a six-mule team hauling two or three cubic yards to the load, which, as above

shown, would represent an average load of 2½ cubic yards or 17½ barrels to the trip, or a day's work of two round trips, of a total average of 5 cubic yards, or 35 barrels of sand a day.

Mr. Fifield states that with a four-mule team hauling ten and sometimes twelve barrels of sand to a load (or an average of eleven barrels), he made one round trip a day to Pilarcitos waste-weir (p. 48). Presumably if he had hauled sand from Millbrae to the Bald Hill tunnel (like Mr. Carey), instead of to Pilarcitos, he also, like Mr. Carey, could have made with his four-mule team two round trips in a day to Bald Hill tunnel (g.), as well as to the large brick shaft (f.), at the inlet end of this tunnel, and to the San Andres waste-weir (h.).

Mr. Fifield's four-mule team, as heretofore shown, averaging 11 barrels of sand to the load, would, therefore, with his two round trips a day to either of the three above structures in the San Andres region, be able to haul an average of 22 barrels of sand at a cost (exclusive of the cost of saving, gathering and screening the sand) of $10 a day.

The hauling alone, therefore, of the sand, from Millbrae to the above structures in the San Andres region, cost at that time $\frac{\$10}{22}$ or 45.4 cents, or, in round figures, 45 cents per barrel, which does not include the additional cost to complainant of saving, gathering, selecting and screening the sand before hauling.

Mr. Schussler, in his estimate of cost of reconstruction for 1903-04 places the cost of suitable sand obtained in San Francisco and delivered at the large shaft (f.) at the inlet end of Bald Hill tunnel and also at the tunnel, at $4.60 per cubic yard (Test. p. 853). This at seven barrels per cubic yard equals

65.7 cents, or, in round figures, 65 cents per barrel, delivered.

This figure includes the cost of loading it on to barges in San Francisco, transporting it along the bay and unloading it on a wharf, loading it on to wagons, hauling it to the respective structures in the San Andres region and there unloading it.

With five barrels of sand used in the cement mortar for each 1,000 bricks laid, the cost of the sand is estimated by Mr. Schussler at $3.25 per thousand bricks laid (p. 853).

Mr. Schussler, in estimating for 1903-04 the cost of brick work in the third structure of the San Andres region, which is the waste-weir (h.), places the cost of delivering suitable sand from San Francisco to this structure, near the San Andres dam, at the same figure of 65 cents per barrel or $3.25 per 1,000 bricks laid.

A recapitulation of what has been here said regarding the sand required for the three brick structures f, g and h, in the San Andres region, gives Mr. Schussler's estimate of cost of delivering suitable sand to the same, from the nearest available place, San Francisco, under the conditions prevailing in 1903-04, as follows:

Name of Structure:	Mr. Schussler's estimate of cost, for 1903-04, of sand delivered from San Francisco to the respective structures:	
	Cost of sand per barrel delivered	Cost of sand per 1,000 bricks laid
f. Large brick shaft at inlet of Bald Hill tunnel..	65 cents	$3.25
g. Bald Hill tunnel.....	65 cents	3.25
h. San Andres waste-weir.	65 cents	3.25

NAME OF STRUCTURE.

C.

SAND FOR THE BRICK WORK IN THE CRYSTAL SPRINGS REGION.

In the Crystal Springs region there are two brick structures:

(i.) The outlet tunnel and shaft, with two inlet branch tunnels, at the main Crystal Springs dam;

(j.) The lower outlet tunnel, with gate shaft, at the upper Crystal Springs dam.

Regarding the cost per cubic yard or per barrel, of sand delivered at either of these two structures at Crystal Springs, neither Mr. Fifield nor Mr. Carey gave any testimony.

The only testimony on this subject, as to what the sand would cost in 1903-04, delivered at either of these two points, is given by Mr. Schussler in his estimates thereon.

i. Sand delivered at shaft and tunnels, at main Crystal Springs dam, per 1,000 bricks laid, $2.75; or 55-424 cents per barrel (p. 927).

j. Sand delivered at shaft and tunnel at upper Crystal Springs dam, per 1,000 bricks laid, $3.25, or 65 cents per barrel (p. 893).

D.

SAND FOR SIX-MILE HOUSE TUNNEL.

The cost of this is given by Mr. Schussler as follows:

k. Sand delivered at both ends of brick tunnel on Crystal Springs conduit line, leading from Visitacion Valley into University Mound district; cost of sand per 1,000 bricks laid, $2.85, or 57 cents per barrel (p. 996).

This sand is hauled entirely by team from the nearest available place—complainant's Lake Merced property (p. 999).

A recapitulation of the results arrived at as to the cost of sand is given in the following Table No. XV:

TABLE XV

RECAPITULATION OF MR. SCHUSSLER'S ESTIMATES OF COST OF SAND IN 1903-04. DELIVERED AT THE FOLLOWING BRICK STRUCTURES

See above text and sub	Name of Structure	Cost of Sand delivered	
		Per barrel	Per 1,000 bricks laid
a	Pilarcitos waste weir	76 cents	$3.80
b	Gate house at Pilarcitos tunnel No. 1	76 "	3.80
c	Pilarcitos tunnels No. 1 and No. 2	76 "	3.80
d	Pilarcitos stone dam brick cap	*(Conditions like *a*, *b* and *c*)	
e	Lock's Creek tunnel No. 1	88.4 "	4.42
f	Brick shaft and inlet tunnel at San Andreas reservoir	65 "	3.25
g	Bald Hill tunnel	** (Conditions like *f*)	
h	San Andreas waste weir	65 "	3.25
i	Gate shaft and tunnels at Crystal Springs main dam	55 "	2.75
j	Gate shaft and tunnel at upper Crystal Springs dam	65 "	3.25
k	Six-mile House tunnel	57 "	2.85

*All materials: sand, cement and brick, are included in cost per 1000 bricks, laid (page 1012).

**All materials: sand, cement and brick, are included in cost per 1000 bricks, laid (page 864).

From what has been shown above regarding the cost of delivering sand at the regions into which the above eleven brick structures, at complainant's peninsular storage reservoirs and on the Crystal Springs conduit

line, have been divided, namely: A, Pilarcitos; B, San Andres; C, Crystal Springs; D, Six-mile House Tunnel, it appears that the testimony of both Mr. Carey and Mr. Fifield affords no basis for determining the cost of sand. Mr. Carey's testimony is vague and indefinite as to the quantity or weight of sand hauled by him to the load as well as to the size of his wagon, and the cost of delivering the sand, and he does not give the cost of saving, gathering and screening the sand.

Mr. Fifield's testimony applies to only one point of delivery out of the eleven involved. His testimony is definite as to the cost per day of a four-mule team and also closely approximates the load hauled daily to Pilarcitos waste-weir (a); but he does not include the cost of saving, gathering and screening the sand.

On the other hand, Mr. Schussler's testimony regarding the cost of sand delivered at not only these eleven structures, but also the other brick structures, as well as concrete structures where sand is used, is given in detail and is very conservative, as is shown by the foregoing comparisons.

The Cost of Cement.

The Testimony of Defendants' Witnesses on This Subject Analyzed and Compared with That of Mr. Schussler.

Regarding the cost of the cement used by complainant, defendants' witness, Mr. Carey, testified as to the hauling of cement to Lock's Creek tunnel No. 1 and to the brick shaft at the inlet end of Bald Hill tunnel, at San Andres reservoir, as follows (defendants' Test. p. 43):

"I could make only one trip a day to the inlet end of the Lock's Creek tunnel, I hauled 2,000 bricks to a load from the 17-mile House.

Q. 14: How many barrels of cement did you haul in one load?

A. 25 barrels of cement and made two trips to the Bald Hill tunnel on the short haul, and one load in the long trip to Lock's Creek tunnel.

Q. 15: In regard to that tunnel, now known as Lock's Creek tunnel, when you hauled to the outlet end of it, how many trips did you make?

A. I made two trips a day to the outlet end of that tunnel.

Q. 16: To the inlet end of that tunnel you made only one trip a day?

A. Yes sir."

Here we have Mr. Carey's testimony that he hauled with complainant's six-mule team, making one round trip a day from Millbrae to the inlet end of Lock's Creek tunnel No. 1, a load consisting of 2,000 bricks at times, and at other times of 25 barrels of cement.

Each of these loads represents in round figures 10,000 pounds, or five (5) tons net.

As heretofore, from his testimony under the head of "Sand," Mr. Carey says that when hauling sand to Bald Hill and Lock's Creek tunnel and to the Pilarcitos gate-house, he hauled "Two or three yards" of sand to a load of complainant's six-mule team, which, as we have seen, is an average of 6,250 pounds for the average of 2½ cubic yards or 7,500 if we allow his outside estimate of three yards. His average, 6,250 pounds net, however, for a six-mule team, agrees proportionately very closely with the 4,000-pound load, that defendants' other witness, Mr. Fifield, hauled over the road to Pilarcitos with his four-mule team.

Mr. Higgins, another witness for defendants, says regarding the hauling of cement to the Pilarcitos stone dam:

"The cement was hauled from Millbrae."

"A 6-mule team would haul in a load of cement, 16 to 20 barrels to the load. That was a day's trip for the team and would do us for two or three days." (Defendants' Test. p. 10.)

"These men lay 5 yards of masonry a day."

"Allowing an entire barrel of cement for each yard laid, I place the cost of the cement, including hauling, at $3." (Test. p. 11.)

This shows that if Mr. Higgins, with his men, laid 5 cubic yards of masonry a day and used 5 barrels of cement a day, in two days he used 10 barrels of cement, and in three days he used 15 barrels of cement. When he says, therefore, as above quoted, that 16 to 20 barrels was a load and lasted two or three days, he evidently estimates the load for a six-mule team too high, as even three days' supply for his force, at the rate of 5 barrels a day, would only amount to 15 barrels to the load. Besides, judging from Mr. Carey's testimony regarding the weight of a load of sand that the six-mule team could haul, which, as above shown, would average about 6,250 pounds, it appears certain that Mr. Higgins' outside estimate of 20 barrels is excessive and that his lower figure of 16 barrels or 6,400, would be nearer the load that a six-mule team could haul over those roads.

Mr. Carey is surely mistaken when he states that he hauled to the Lock's Creek tunnel outlet as well as inlet, 25 barrels, or about 10,000 pounds of cement to a load, with a six-mule team, while of sand he could only haul with the same team about 6,250 pounds.

In addition to this great discrepancy in Mr. Carey's testimony regarding the load that he could haul with the six-mule team comes (as already shown under the head of "Sand") his evidently erroneous statement (Test. p. 45) that while hauling cement he made one trip a day to the inlet end of Lock's Creek tunnel No. 1. As shown under the head of "Sand," there never existed a wagon road leading to this tunnel inlet, nor does one exist there now. The cement, with other materials, after having been hauled to the top of the ridge above the tunnel, was sledded down to the tunnel inlet (Complainant's Test. pp. 1018-19), which process, owing to the absence of a road to the tunnel inlet, would be followed again as a measure of economy, if the same tunnel were to be reconstructed in 1903-04.

Mr. Carey's statement that, with a six-mule team, he hauled 25 barrels of cement, or 10,000 pounds to the load, making two round trips a day from Millbrae to the outlet end of Lock's Creek tunnel No. 1, has already been proven to be impossible, while discussing the sand which was hauled to the same tunnel outlet. It was there shown that a six-mule team, hauling sand from Millbrae to the outlet end of Lock's Creek tunnel No. 1, could at most make only one round trip a day with 6,250 pounds to the load, which is also nearly equivalent, in weight, to 16 barrels of cement.

As heretofore shown, under the head of "Sand," defendants' other witness on teaming, Mr. Fifield, hauled from Millbrae to Pilarcitos, with a four-mule team, 10 and sometimes 12 barrels of sand, making one round trip a day; which, as shown, represents an average daily load hauled over those roads of nearly 4,000 pounds. This weight of 4,000 pounds also represents the weight of 10 barrels of cement as a load for Mr.

Fifield's four-mule team. If therefore he had added two more mules to his team, thereby making it a six-mule team, he might have been able to haul a proportional additional number of barrels of cement, so that the total load for his six-mule team might have been 16 barrels of cement, with a total weight of 6,400 pounds.

This gives further proof that Mr. Carey, when he testifies that he hauled 25 barrels of cement to the load with a six-mule team, representing a total weight of 10,000 pounds to the load, is mistaken; and also that his testimony as to the number of trips made daily to the Lock's Creek tunnel outlet, is as unreliable as what he says about having hauled materials directly to the inlet end of the Lock's Creek tunnel.

The following Table XVI gives from Mr. Schussler's testimony his cost estimates for 1903-04 for the delivery of cement to the various brick structures, heretofore enumerated in the discussion on "Sand," under the heads of a, b, c, d, e, f, g, h, i and j.

This shows that the cost of cement delivered at the respective structures varies with their distance from distributing centers, as well as with the degree of accessibility of the structures, and the grade and character of the roads. There is also a slight difference between the cost of team hire in the City and County of San Francisco and in San Mateo County, which difference is in favor of the latter.

thousand.''

* Instead of "power," should read "method of."

TABLE XVI

RECAPITULATION OF MR. SCHUSSLER'S ESTIMATES OF COST IN 1903–4 OF CEMENT, DELIVERED AT THE FOLLOWING BRICK STRUCTURES OF COMPLAINANT

1 Designation of structures in Table XV	2 Page in Complainant's testimony	3 Name of Structure	4 Cost per barrel in San Francisco*	5 Total cost per barrel delivered at railroad depot nearest to structure	6 Number of barrels hauled to respective structure per each 4-horse load	7 Number of round trips made by team each day	8 Total number of barrels of cement hauled by one 4-horse team in a day	9 Cost of 4-horse team per day, inclusive of maintenance and driver	10 Cost per barrel of hauling from railroad depot to respective structure. Cents	11 Total cost per barrel of cement delivered at the respective structure	12 Number of barrels of cement used per 1,000 bricks laid	13 Cost of cement per 1,000 bricks laid	REMARKS
a	753	Pilarcitos waste-weir	.....	$ 2.75	12	1	12	$ 7.50	62.5	$ 3.37½	2½	$ 8.45	
b	765	Gate-house at Pilarcitos tunnel No. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.45	Cost of cement and transportation alike for a, b, c.
c	771	Pilarcitos tunnels No. 1 and No. 2	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.45	
d	1012	Pilarcitos stone dam, small brick cap	.....	.....	.....	.....	.....	.....	.....	.....	.....	Note: conditions like a, b, c.	All materials (sand, cement, brick) are included in cost per 1,000 bricks laid (page 1012).
e	1019	Lock's Creek tunnel No. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	$ 8.76	Cement and hauling like a, b, c, d; extra cost for sledding cement down-hill.
f	852–853	Brick shaft and inlet tunnel at San Andreas reservoir	$ 2.65	2.75	12	2	24	7.50	31.2	3.06	2½	7.65	
g	864	Bald Hill tunnel	.....	.....	.....	.....	.....	.....	.....	.....	.....	Note: conditions like f.	All materials (sand, cement, brick) are included in cost per 1,000 brick laid. (p. 864).
h	822–823	San Andreas waste-weir	2.65	2.75	12	2	24	7.50	31.2	3.06	2½	7.65	
i	926–927	Gate shaft and tunnels at Crystal Springs main dam	2.65	2.75	16	1½	24	7.50	31	3.06	2½	7.65	Practically level road most of the way and without long, steep grades.
j	892–893	Gate shaft and tunnel at Upper Crystal Springs dam	2.65	2.75	16	1½	24	7.50	31	3.06	2½	7.65	Practically level road most of the way and without long, steep grades.
k	998–999	Six-mile House tunnel near San Francisco County line	At ship or warehouse in San Francisco $ 2.65	$ 2.65	16	1½	24	8.00	33	2.98 add extra 2 = 3.00	2½	7.50	Cement hauled from ship or warehouse in San Francisco directly to both ends of tunnel.

The Cost of Brick.

For the Brick Structures in the Pilarcitos, San Andres and Crystal Springs Regions, and for the Six-Mile House Tunnel, Near the San Francisco County Line.

Regarding the quality of the brick used by complainant in its brick-work structures, the following quotation from page 839 of Mr. Schussler's testimony on the quality of its brick work shows some of the reasons why, aside from first-class workmanship, cement and sand, it is essential that also the brick used should be of first-class quality:

> "Our work is of such great importance and is subjected to such strains and such severe tests that we cannot afford to do poor work or cheap work."

Otherwise, even with first-class workmanship, cement and sand, but with poor and unsuitable brick, the brickwork would be a failure for the purposes intended.

Referring to the quality of brick used by complainant and to the cost per 1,000 brick in 1903-04, delivered to the most convenient railroad station, he says (p. 2124):

> "We always buy our brick delivered, so as to make the brick-maker take the risk of breakage. We only buy whole brick, and, therefore, by a *power making him responsible for the breakage during transportation, he is compelled to pack the brick carefully. We unload them when we get them at the station."
>
> X. Q. 2600: "Do you not get a reduction when you take them in large quantities?"
>
> A. "We always get large quantities, and for that reason we get the brick delivered to us at $10.50 per thousand."

* Instead of "power," should read "method of."

X. Q. 2601: "Do you know what brick ordinarily cost?"

A. "I do not know. We do not use ordinary brick. If you mean brick like they are using in the street, or in the various departments of public works—sewers, etc., such as I have seen going in the various public works or in buildings or in chimneys, that is a different kind of brick. We do not use that kind. We only use hard-burned brick, so that if you take two and strike them together they ring with a sound, showing thorough compactness and first-class burning."

Coupling the above, relating to the quality of the brick used, with what Mr. Schussler says (as hereafter quoted from pages 2467-8) it will be seen that in complainant's brick work extraordinary care was exercised in inspecting, selecting and culling the bricks out of the brick kilns, wherever located.

Regarding the cost of 1,000 bricks in 1903-04 (so inspected, selected and culled and delivered to complainant at the nearest railroad station, Mr. Schussler says (Test. pp. 821-2):

"We culled and selected the brick out of the brickyards and, including the wages and expenses of our inspector at the brickyard, the brick delivered at Millbrae cost $11. That is the kind of selected, choice, hard-burned brick that we took."

Counsel for defendants endeavor to create the impression that complainant used a poor quality of brick in some of its brick-work structures by quoting the testimony of Mr. Higgins, who, in past years was first engaged as contractor for some of complainant's brickwork, and who later was off and on employed until 1888 as foreman bricklayer for complainant.

No reasons are assigned why complainant did not continue to employ Mr. Higgins as contractor, nor why

since 1888 he has not been in the employ of complainant in any capacity. From the whole tenor of his testimony, however, he was evidently a hostile witness.

Testifying as to the brick laid in the Bald Hill tunnel he says (Defendants' Test. p. 3):

> "The brick laid in the Bald Hill tunnel were supplied by Mr. Walker, who was supervisor and sheriff of San Mateo County. These brick were slop made and were made on Bald Hill by Chinamen."

Counsel for defendants seize on this isolated piece of testimony and make it the basis of a paragraph on page 430 of their brief which might give the impression that all the brick used in complainant's structures were of inferior quality and that therefore Mr. Schussler's estimates of that item of cost are excessive.

Testifying as to the cost of these particular brick Mr. Higgins says:

> "Mr. Walker made them for the company at $6 per thousand."
>
> Q. 11: "Did the company supply the wood?"
>
> A. "They were to supply the wood. Mr. Walker made these brick for $6 per thousand complete, the company to supply the wood to burn them with."
>
> Q. 12: "And they cost how much?"
>
> A. "About $8. I do not know much about that, but I think it was about that."
>
> Q. "$8 altogether?"
>
> A. "Yes sir."

It is evident that Mr. Higgins could know nothing of his own knowledge as to the price Mr. Walker was to be paid or was paid for making the brick. Mr. Higgins' work was merely to lay them. He says that Walker was paid $6 a thousand, but complainant furnished the firewood, delivered to the brick-maker at the kiln, at its own expense. He neither gives nor

estimates the sort of the firewood nor the cost of delivering it at the kilns. As to the total cost of the bricks, he says himself he does "not know much about that," but "thinks it was about" $8 a thousand.

Mr. Schussler's testimony says that all complainant's work called for whole, unbroken brick, and that "we culled and selected the brick out of the brickyards." This would make an additional cost to the complainant of fifty cents per thousand for culling and inspection at the kiln (Complainant's Test. p. 2466):

Mr. Schussler in his testimony on the cost of selected brick in 1903-04, delivered by rail at Millbrae or San Mateo, places their cost, including complainant's expenses for culling and inspection, at $11 per thousand, says (p. 2466):

> "I stated this morning that we contract with the brickyard to allow us to cull the brick kiln by careful men and to select the brick out of the kiln. I stated this morning that we pay $10.50 per thousand brick, thus culled or picked and selected out of the kiln and then by the brickyard people loaded on the cars and then by the railroad company transferred to one of these stations—the central portion of that region being Millbrae Station. Deducting from that $10.50 per 1,000 the $2 per thousand the railroad company charges for freight, it leaves to the brickyard people for this specially selected brick $8.50 per 1,000."
>
> * * *
>
> "Now and during the past two or three years we have been paying $10.50 for the brick so selected, loaded on the cars and delivered by rail, plus the cost of inspection, which, in round figures, is about 50 cents per thousand, making the brick delivered at the respective railway stations cost us $11 per thousand."

Mr. Higgins' intimation that the bricks selected by complainant from the Bald Hill kilns and used in some of its structures were unfit "slop made"—which, if true, would indicate an inferior quality—is disproven by the fact that, in the first place, no such unfit and unsuitable brick would pass complainant's rigid requirements and inspection; and, in the second place, such poor brick as Mr. Higgins intimates were used for this work would not have withstood the test of time and the strains and wear and tear to which the structures have been subjected through the decades that have elapsed since their construction.

The very fact that the brick in the four structures in which the hard-burnt selected brick, culled from the former kilns on Bald Hill were used, namely, the Pilarcitos tunnel No. 1 (Defendants' Test., p. 8); the inlet portion of Lock's Creek tunnel No. 1 (Defendants' Test., p. 13); Bald Hill tunnel (Defendants' Test., p. 4); portion of San Andres waste-weir (Defendants' Test., p. 15); have been ever since their construction and are now in first-class condition, is ample proof and evidence that they were of a superior quality and were suitable for the work, and that they were not inferior in quality, as Mr. Higgins attempts to insinuate.

So far, as to the good quality of the brick used by complainant in its brick structures.

Mr. Schussler, estimating the cost of reconstructing the structures in 1903-04, figures that the culled and selected brick required would cost now, delivered by rail at the respective railroad stations, $11.00 per thousand.

As the cost of hauling to the places where the bricks would be required for use is an important factor in the total cost, we will, before giving Mr. Schussler's detailed estimates, refer to the testimony of defendants'

two witnesses, Mr. Carey and Mr. Higgins, on that subject.

Mr. Carey, in speaking of hauling brick, with complainant's six-mule team, from Millbrae to two brick structures on complainant's peninsular system, says (pp. 42, 43):

Q. 8: "What was the first work you did on the mule team?"

A. "I hauled the brick and cement into the Pilarcitos Valley from Millbrae—we used to call it the 17-mile house; also to the Bald Hill tunnel, which was being done by Jim de Noon, and to the Lock's Creek tunnel."

Q. 9: "You hauled bricks from Bald Hill to the inlet of Lock's Creek tunnel?"

A. "Yes sir."

Q. 10: "How many bricks did you haul a day to the inlet end of the tunnel?"

A. "I made one trip a day when I made that long trip to the inlet, and with a six-mule team. I hauled 2,000 brick to the load."

Q. 11: "When you hauled bricks to the outlet end of the tunnel, where did you get them?"

A. "They also came from Bald Hill."

Q. 12: "How many bricks did you haul a day to the outlet end of the tunnel?"

A. "I could make two trips a day to the outlet end of the tunnel. I could haul 4,000 bricks in a day, that is, 2,000 bricks to the load, or else I would haul one load of bricks and then get a load of cement. I made two trips a day from San Andres to the outlet end of the Lock's Creek tunnel."

Q. 13: "When you hauled bricks from Millbrae or the 17-mile house to the Bald Hill tunnel, how many trips a day did you make?"

A. "When I hauled brick or cement from the 17-mile house or Millbrae down, I made two trips to the Bald Hill tunnel, but I could make only one trip a day to the inlet end of the Lock's Creek tunnel. I

hauled 2,000 bricks to a load from the 17-mile house."

Q. 14: "How many barrels of cement did you haul in one load?"

A. "Twenty-five barrels of cement, and made two trips to the Bald Hill tunnel on the short haul and one load in the long trip to Lock's Creek tunnel."

Q. 15: "In regard to that tunnel, now known as Lock's Creek tunnel, when you hauled to the outlet end of it, how many trips did you make?"

A. "I made two trips a day to the outlet end of that tunnel."

Q. 16: "To the inlet end of that tunnel you made only one trip a day?"

A. "Yes sir."

Q. 17: "Could you make two trips a day?"

A. "I could make a trip and a half a day. I could go down again and load up and put up my team. If I were doing that work at the present time I could average a trip and a half in ten hours, but working only eight hours I could make only one trip a day with a six-mule team hauling 2,000 bricks or 25 barrels of cement."

Q. 18: "What salary did you get?"

A. "My salary was $70 a month and board."

From this testimony we gather the following summary of what Mr. Carey asserts to be facts:

a. Mr. Carey could and did haul over the roads, in their condition at that time, and with complainant's six-mule team, 2,000 brick or 25 barrels of cement to each load;
b. While hauling this load of brick, he made two round trips a day from Bald Hill to the outlet end of Lock's Creek tunnel No. 1; and one round trip a day to the inlet end of this tunnel;
c. While hauling a load of 10,000 pounds of either brick or cement from Millbrae to Bald Hill tunnel he made two round trips a day;
d. While he hauled this load of brick or cement from

Millbrae to the inlet end of Lock's Creek tunnel No. 1 he made one round trip a day; but, if he were doing this hauling at the present time to the inlet end of Lock's Creek tunnel he could, with the same load, average a trip and a half a day in ten hours; in a day of 8 hours, however, he could make at the present time only one round trip a day;

e. While he hauled the same load from Millbrae to the outlet end of Lock's Creek tunnel No. 1 he made two round trips a day.

In our discussion on the cost of hauling "Sand" and "Cement" it has been clearly shown that the net weight a four-mule team and a six-mule team respectively could haul over the roads as they existed at the time when defendants' witnesses, Mr. Fifield and Mr. Carey, were hauling sand or cement for complainant, was about 4,000 pounds for a four-mule team, and from 6,250 to 6,400 pounds for a six-mule team. Mr. Carey's claim that he hauled with a six-mule team, over these mountain roads, in the condition in which they were at that time, 2,000 bricks to the load, or 10,000 pounds, is untenable and disproved by his own and Mr. Fifield's testimony regarding the net weight of the respective average loads of sand that they could haul.

Referring to the number of bricks that these two respective loads of 4,000 pounds for a four-mule team and 6,250 to 6,400 pounds for a six-mule team would represent, it is shown that 1,000 bricks weigh about 2½ tons, or 5,000 pounds (Complainant's Test., p. 752), so that the weight of each brick is about 5 pounds, and Mr. Fifield's four-mule team load of 4,000 pounds would represent 800 bricks, while Mr. Carey's load of from 6,250 to 6,400 pounds for his six-mule team would be 1,250 to 1,280 bricks, and not 2,000, as he attempts to show.

As heretofore shown in the discussion of "Sand," it was not possible to make, with the six-mule team, as Mr. Carey states, two round trips a day from Millbrae to the outlet of Lock's Creek tunnel No. 1, either with a load of 2,000 bricks each, or with a load of between 1,250 and 1,280 bricks each. All he could make in a day at that time, as above shown, was one round trip only in a day with the latter load. As also shown in the same place, there being no road to the inlet end of Lock's Creek tunnel No. 1, either at that time or at the present time, Mr. Carey's testimony that he hauled with the six-mule team brick, as well as sand and cement, to the inlet end of Lock's Creek tunnel No. 1, does not state the facts and indicates lapse of memory. As the materials were being hauled by the teams, not to the tunnel inlet, but to the top of the ridge above the tunnel, Mr. Carey could make only one round trip a day, with the six-mule team, from Millbrae, while hauling not to exceed 6,400 pounds to the load, instead of 10,000 pounds, as he thinks. Furthermore, when he says that, with the present condition of the roads, he could now make one and one-half round trips a day from Millbrae, in a day of ten hours, while hauling 10,000 pounds with a six-mule team to the Lock's Creek tunnel inlet, he is again mistaken, as, with a six-mule team, he can haul an average load from Millbrae to the top of the ridge, over the Lock's Creek tunnel No. 1, of about 6,400 pounds only; and, while hauling this daily load from Millbrae station to this ridge, instead of 1½ round trips a day, he can, with the present condition of the roads, make one round trip only in a day of eight hours.

As above stated in discussing "Sand," these materials were hauled to the top of the ridge above the tunnel, were there unloaded, and were sledded down

hill, at an additional expense to complainant, to the otherwise inaccessible inlet end of the tunnel, and the same process would have to be employed now as a measure of economy, in reconstructing this tunnel in 1903-04. When Mr. Carey says that he hauled, with the six-mule team, 10,000 pounds of either brick or cement to the load, from Millbrae to Bald Hill tunnel, in a ten hour day, he is again mistaken.

Mr. Schussler testifying on the subject of hauling brick from Millbrae over Bald Hill ridge to Bald Hill tunnel, says (p. 822):

> "Six four-horse teams make two round trips a day over Bald Hill, hauling about 1,000 brick to the load; in other words, the six four-horse teams haul 12,000 brick a day."

This places each four-horse load at 5,000 pounds, or 1,000 bricks, at the present time, with the improved condition of the roads.

Mr. Higgins, testifying as to the cost of brickwork in Pilarcitos tunnel No. 1, in 1871, uses a random figure of $5.00 for hauling 1,000 brick from the Bald Hill brick kilns to Pilarcitos tunnel No. 1 (Defendants' Test., p. 10). He does not, however, say how he obtains this figure, and Mr. Carey gives no cost figure regarding the hauling of these brick.

The only testimony that defendant produces that is of any value on this subject is that of Mr. Fifield, who with his four-mule team, in the early days of the company, hauled sand and lumber to Pilarcitos. He says that for his four-mule team, including driver and maintenance, he received $10.00 a day; that he hauled 1,000 feet of lumber a day for the Pilarcitos flume, making one trip a day from San Bruno station; that when hauling sand from Millbrae he hauled ten barrels, and some-

times twelve barrels, of sand to the load, to Pilarcitos, making one round trip a day (pp. 47, 48). As we have seen, his load of sand averaged about 4,000 pounds, which represents the weight of about 800 bricks. At the cost of $10.00 a day for a four-mule team hauling 800 bricks to the load and making one round trip a day between Millbrae and Pilarcitos, the cost of the hauling brick per thousand, so delivered: $10×1,000 divided by 800, or $12.50 per 1,000.

This shows that Mr. Higgins' allowance of $5.00 a thousand for teaming is only 40 per cent of the actual cost according to Mr. Fifield's testimony.

To recapitulate the results shown by analysis of defendants' testimony:

Mr. Carey does not give any cost figures whatsoever for the hauling of brick from the Bald Hill brick kilns to Lock's Creek tunnel No. 1, nor for the hauling of brick from Millbrae to the large brick gate shaft at San Andres Reservoir at the inlet end of Bald Hill tunnel; nor for the hauling of brick from Millbrae to Pilarcitos Valley.

Mr. Carey's testimony regarding the excessively large loads that he says he hauled with a six-mule team is unreliable, and does not at all correspond proportionately with the loads that Mr. Fifield, the other witness for defendant, hauled over the same roads with his four-mule team.

Mr. Carey could not have made the number of round trips which he claims he made in a day, even with the much smaller load which he actually could have hauled over those roads at that time.

Mr. Carey's testimony shows a wide divergency between the weight of the load of about 10,000 pounds of brick or cement, on the one hand, and that of the load of about 6,250 pounds of sand, that he could haul with

the same six-mule team over the same roads, on the other hand.

Mr. Carey's statement that he hauled brick, cement and sand directly to the inlet end of Lock's Creek tunnel No. 1 was erroneous, as there was no wagon road leading to that tunnel inlet, neither at that time nor since.

Mr. Higgins' allowance of $5 per 1,000 for the cost of hauling brick from the Bald Hill kilns to Pilarcitos tunnel No. 1 is a mere guess with nothing to support it.

The following Table XVII gives, from Mr. Schussler's testimony his cost estimates, for 1903-04, of brick delivered to the various brick structures heretofore enumerated in Table XV, on sand, and in Table XVI on cement, under the designations of letters a, b, c, d, e, f, g, h, i, j and k.

The cost per thousand of brick delivered at the various structures includes the cost per thousand of carefully inspected and selected hard-burn brick, railroad transportation, loading on wagons, hauling by team, unloading at structure, and, in case a structure is inaccessible by team, includes the cost of extra handling and transportation to the structure.

These cost estimates per thousand bricks delivered at the various structures are based upon Mr. Schussler's experience (especially as to the regions where these structures are erected) not only as to the weight to the load, that can be hauled by teams over the respective roads and grades, but also as to the number of round trips that can be and are being made in a day.

The table shows that the cost of brick, delivered at the respective structures, varies with the distance of the region in which they are located, from distributing

TABLE XVII

SCHUYLER'S ESTIMATES OF COST, IN 1903–04, OF BRICK DELIVERED AT THE FOUNDATION OF A STRUCTURE OF CONSIDERABLE SIZE

6	7	8	9	10	11
Number of brick hauled to respective structure per each 4-horse load	Number of round trips made by each 4-horse team per day	Total number of brick hauled by each 4-horse team per day	Cost of 4-horse team per day, inclusive of maintenance of team and inclusive of driver's wages and board	Cost, per 1,000 of brick of hauling only from depot to respective structure	Cost of delivering 1,000 bricks from depot to respective structure, including loading on wagons, hauling and unloading at structure
1,000	1	1,000	$ 1 50	$ 1 50	$ 3 00
Note—Conditions like *a*.			1 50	1 50	3 00
Note—Conditions like *a* and *b*.			1 50	1 50	3 00
					10 00
1,000	2	2,000	1 50	3 75	4 25
1,200	1½	1,800	1 50	4 16	4 65
1,000	1½	1,500	1 50	5 00	6 00
1,200	1½	1,800	8 00	4 45	5 00

TABLE XVII

RECAPITULATION OF MR. SCHUSSLER'S ESTIMATES OF COST, IN 1903–04, OF BRICK DELIVERED AT THE FOLLOWING BRICK STRUCTURES OF COMPLAINANT

1	2	3	4	5	6	7	8	9	10	11	12	13
Designation of structures in Tables XV and XVI	Page in complainant's testimony	Name of Structure	Cost per 1,000 selected bricks, inclusive of cost of inspection and freight delivered at railroad depot nearest to respective structure	Cost per 1,000 bricks of unloading from cars at depot, loading on to wagons and unloading at structures	Number of brick hauled to respective structure per each 4-horse load	Number of round trips made by 4-horse team per day	Total number of brick hauled by each 4-horse team per day	Cost of 4-horse team per day, inclusive of maintenance of team and inclusive of driver's wages and board	Cost, per 1,000 brick of *hauling only* from depot to respective structure	Cost of delivering 1,000 bricks from depot to respective structure, including loading on wagon, hauling and unloading at structure	Total cost per 1,000 bricks, delivered at the respective structures, being the sum of items in columns 4 and 11	Remarks
a	751–2–3	Pilarcitos waste-weir	$11.00	83 cents	1,000	1	1,000	$ 7.50	$ 7.50	$ 8.33	$19.33	
b	764	Gate-house at Pilarcitos tunnel No. 1	11.00	83 cents	Note—Conditions like *a*.			7.50	7.50	8.33	19.33	
c	771	Pilarcitos tunnels No. 1 and No. 2	11.00	83 cents	Note—Conditions like *a* and *b*.			7.50	7.50	8.33	19.33	
d	1012	Pilarcitos stone dam, *small brick cap*									Note–Conditions like *a*, *b* and *c*.	All materials—Sand, cement and bricks, are included in *cost per* 1,000 *bricks laid.* (p. 1012)
e	1018–19	Lock's Creek tunnel No. 1	11.00							10.33	21.33	The $10.33 includes extra cost of delivering bricks from team to tunnel. (pp. 1018-19)
f	852	Brick shaft and inlet tunnel at San Andreas reservoir	11.00	83 cents	1,000	2	2,000	7.50	3.75	4.58	15.58	
g	864	Bald Hill tunnel									Note–Conditions like *f*.	All materials—Sand, cement and bricks are included in *cost per* 1,000 *bricks laid.* (p. 864)
h	822	San Andreas waste-weir	11.00	83 cents	1,000	2	2,000	7.50	3.75	4.58	15.58	
i	925–6	Gate-shaft and tunnels at Crystal Springs main dam	11.00	69 cents	1,200	1½	1,800	7.50	4.16	4.85	15.85	
j	891–2	Gate-shaft and tunnel at upper Crystal Springs dam	11.00	69 cents	1,000	1½	1,500	7.50	5.00	5.69	16.69	
k	997–8	Six-mile house tunnel near San Francisco county line	11.00	55 cents	1,200	1½	1,800	8.00	4.45	5.00	16.00	

centers, as well as with the degree of accessibility of the structures, and the grade and character of the roads. There is also a slight difference in favor of the country, between the cost of team hire in San Francisco County and in the counties outside of San Francisco.

As shown in the respective parts of Mr. Schussler's testimony, the cost of loading the bricks on and unloading them from the wagons also varies somewhat under the different conditions.

Recapitulation Showing the Cost of These Three Items Together for Brick, Cement and Sand Delivered.

The following Table XVIII gives from Mr. Schussler's testimony, as condensed and recapitulated on Tables XV, XVI and XVII, his estimates for 1903-04 of the cost complete (exclusive of incidental, contingent, etc., expenses) of the materials required for the brick work in the brick structures of complainant enumerated; these materials being: sand, cement and brick.

The cost in this table includes the original cost of sand and cement and their transportation, handling, hauling and delivery to the respective structures. It also includes the cost of carefully inspected and selected hard-burnt brick, railroad transportation, loading on wagons, hauling by team, unloading at structure, and, in case that a structure is inaccessible by team, includes the cost of extra handling and transportation to the structure.

LABOR CONNECTED WITH THE LAYING OF BRICK.

Cost of this Item of the Brick Work as Shown

the space so created.

Aside from the San Andres inlet work, the longer brick-lined tunnels, detailed in complainant's testimony, in which, on account of the small size of the drift

TABLE XVIII

BEING A RECAPITULATION OF MR. SCHUSSLER'S ESTIMATES FOR 1903-04, OF THE COST FOR EACH ONE THOUSAND BRICKS LAID; FROM TABLE XV, OF THE COST OF SAND, DELIVERED AT THE RESPECTIVE STRUCTURE; FROM TABLE XVI, OF CEMENT; AND FROM TABLE XVII, OF BRICK, PER EACH ONE THOUSAND BRICK LAID IN THE STRUCTURE; INCLUSIVE OF THE COST OF ALL THESE MATERIALS, AS WELL AS THE COST OF INSPECTION, SELECTION, TRANSPORTATION TO DISTRIBUTING CENTERS, LOADING ON WAGONS, HAULING, AND UNLOADING AND DELIVERY AT THE RESPECTIVE STRUCTURES:

Designation of structures in Tables XV, XVI and XVII	NAME OF STRUCTURE	COST OF MATERIALS *for each* 1,000 *bricks, delivered* at the respective structures			TOTAL COST (exclusive of incidental, contingent, etc., expenses) *of all materials*, namely: sand, cement and brick, delivered at the respective structures	REMARKS
		Sand (Table XV)	Cement (Table XVI)	Brick (Table XVII)		
a	Pilarcitos waste-weir	$3.80	$8.45	$19.33	$31.58	
b	Gate-house at Pilarcitos Tunnel No. 1	3.80	8.45	19.33	31.58	
c	Pilarcitos Tunnels No. 1 and No. 2	3.80	8.45	19.33	31.58	
d	Pilarcitos stone dam—*small brick cap*	Note: (conditions like a, b and c)			.....	All materials, sand, cement and brick, are included in *cost per thousand bricks laid.* (p.1012)
e	Lock's Creek Tunnel No. 1	4.42	8.76	21.33	34.51	
f	Brick shaft and inlet tunnels at San Andreas reservoir	3.25	7.65	15.58	26.48	
g	Bald Hill tunnel	Note: (conditions like f)			.....	All materials, sand, cement and brick, are included in *cost per thousand bricks laid.* (p.864)
h	San Andreas waste-weir	3.25	7.65	15.58	26.48	
i	Gate-shaft and tunnels at Crystal Springs main dam	2.75	7.65	15.85	26.25	
j	Gate-shaft and tunnel at Upper Crystal Springs dam	3.25	7.65	16.69	27.59	
k	Six-mile House tunnel, near San Francisco County line	2.85	7.50	16.00	26.35	

Labor Connected With the Laying of Brick.

The Cost of This Item of the Brick Work as Shown by the Testimony.

All labor involved in procuring the sand, cement and brick and in loading and hauling them to and unloading them at the sites of the several structures where they would be required to be used is included in the preceding discussion and the results are recapitulated in the foregoing Tables XV, XVI, XVII and XVIII.

The present subdivision will deal with the cost of the labor, after the delivery of these materials at the various structures. This cost includes: the labor of handling and transporting from the place of delivery to the place or places where the bricklayers and their assistants are at work laying the brick; the bricklayers' assistants, such as hod-carriers, mortar-mixers and other helpers; the bricklayers, themselves, who do the mechanical work of laying the brick and mortar; the carpenter work required for the preparation of wooden templets and centers to guide the bricklayers in the proper construction, dimensions and forms of the bottom, sides and the top arches of tunnels.

The carpenter also assists in taking out of the tunnel the timbers, wherever possible, so as to make room for the brick work; while, in cases where it would be dangerous to take out the timbers, extra labor is necessary to so trim or raise the same as to accommodate the brick masonry of the standard dimensions, within the space so created.

Aside from the San Andres inlet work, the longer brick-lined tunnels, detailed in complainant's testimony, in which, on account of the small size of the drift

and the cramped and unfavorable conditions under which the work of building the brick lining has to be carried on, are seven in number, with a total length of about 19,000 feet, requiring in their construction a total of nearly 4,600,000 bricks, and a corresponding proportion of cement and sand.

The following Table XIX gives the names and lengths of these longer, brick-lined tunnels, the page in complainant's testimony referring to them, and the number of bricks used in their construction:

TABLE XIX

CONTAINING FIRST SERIES OF COMPLAINANT'S BRICK STRUCTURES, CONSTRUCTED UNDER DIFFICULT CONDITIONS

Designation of structure in Tables:	Page of complainant's testimony	Name of Structure	Length in Feet	Number of Bricks Required
XVIII *c.*	770	Pilarcitos Tunnel No. 1	1,550′	341,000
" *e.*	775	Pilarcitos Tunnel No. 2	3,420′	752,000
" *g.*	1018	Lock's Creek Tunnel No. 1	3,200′	704,000
" *j.*	864	Bald Hill Tunnel	2,820′	564,000
" *k.*	851	San Andreas brick shaft and inlet tunnel		245,000
XXV *o.*	996	Six-mile House Tunnel	2,145′	430,000
" *n.*	1240	Lake Merced Drainage Tunnel	3,050′	1,244,000
	790–1	Lake Honda Tunnel	2,820′	564,000
		Totals.	19,005′ of long tunnels.	4,844,000 bricks.

Note—Items c, e, g and k are shown in Table XVIII, regarding the cost of Sand, Cement and Brick delivered at these structures.

The larger tunnel shaft and arched gate-house work in complainant's works, in which there is more space and less inconvenience for the bricklayers and their assistants and helpers to work, than in the seven long and small tunnels, consist of six principal structures, shown in the following Table XX:

TABLE XX

CONTAINING THE SECOND SERIES OF COMPLAINANT'S BRICK-WORK STRUCTURES, CONSTRUCTED UNDER LESS DIFFICULT CONDITIONS THAN THE STRUCTURES IN TABLE XIX

Designation of structure in Tables	Page of complainant's testimony	Name of Structure	Number of bricks required
XVIII *a*	751	Pilarcitos waste weir	305,600
XVIII *h*	820	San Andreas waste weir	696,000
XVIII *i*	924–5	Gate-shaft and tunnels, Crystal Springs main dam	940,000
XVIII *j*	891	Gate-shaft and tunnel at Upper Crystal Springs dam	352,000
XXV *p*	1256	Tunnel and gatewell between North and South Lake Merced	65,700
XXV *q*	1354	Lake Honda sewer tunnel	480,000
		Total	2,839,300

Note—Items a, f, h, i and j are shown in Table XVIII, regarding cost of sand, cement and brick.

The third and last series of complainant's brick structures, shown, which, on account of being built in the open, offer the least difficulty to the bricklayers and their assistants and helpers, consist of seven structures shown in the following Table XXI:

TABLE XXI

CONTAINING THE THIRD SERIES OF COMPLAINANT'S BRICKWORK STRUCTURES, CONSTRUCTED MOSTLY IN THE OPEN AND UNDER MORE FAVORABLE CONDITIONS THAN THOSE IN TABLE XX, AND PARTICULARLY, THAN IN TABLE XIX

Designation of structure in Tables	Page of complainant's testimony	Name of Structure	Number of bricks required
XVIII *d*	1012	Pilarcitos stone dam, small brick cap	10,700
" *b*	764	Pilarcitos gate-house	80,500
XXV *t*	1237	Lake Merced drainage canal	480,000
" *u*	1353	Lake Honda reservoir	868,000
" *v*	1404	Lombard street reservoir	346,000
" *w*	1424	Potrero Heights reservoir	162,000
" *x*	1415	Francisco street reservoir	464,000
		Total	2,411,200

Recapitulating from Tables XIX, XX and XXI, we have the following total number of bricks required in the construction of those brick structures of complainant enumerated in these three tables:

TABLE XXII

Being a Recapitulation from Tables XIX, XX, XXI.

TABLE XIX:	number of bricks..	4,844,000
TABLE XX:	number of bricks..	2,839,300
TABLE XXI:	number of bricks..	2,411,200
Total number of bricks.....		10,094,500

or, in round figures: 10,095,000 bricks.

The Cost of Bricklaying.

Before proceeding with the detailed estimates of the cost of the labor connected with the work of bricklaying, the following quotation from Mr. Schussler's testimony will illustrate the high character of the work and account largely for the cost necessary to reproduce it, Mr. Schussler says (Test. p. 839):

Q. 1099: "I noticed you used the words that in laying the brick you laid them with first-class joints, handling each individual brick. Can you give a little description of that and state the reasons why?"

A. "What I stated was, treating each individual brick as an individual. Our work is of such great importance, and it is subjected to such strains and such severe tests that we cannot afford to do poor work or cheap work. It is not a question with us how many brick can a man lay a day, but how many brick can a first-class man lay well and thoroughly, so that each brick cannot be laid any better. That always means without any waste of time whatsoever. If a man tries in that kind of very important and responsible work to lay brick like for instance they do in the general work in San Francisco sewers, or the general brick work in buildings in San Francisco, that man would be at once discharged, because he could not possibly devote the care and attention

to that work that is demanded on account of the importance of the work. Therefore, we not only selected and picked out the very best and most skilled bricklayers we could find, but we also select the very best brick that we can find; we are very particular about the quality of our cement, of the sand and of the proper mixture of the mortar and that the brick are thoroughly saturated with water, so that in being put in they do not absorb the moisture out of the mortar too quickly, thereby making an apparently rapid setting, but which afterwards injures the strength of the work. In that way we compel every man who works for us to do his work thoroughly well. There is no better brick work anywhere in the world than the brick work that we are doing and will, for the character of the work that we do; it is cheap because no piece of brick work that we have ever done has ever given out on us or has ever required any repair."

Q. 1100: "As an hydraulic engineer, do you consider this system of laying brick justified and proper, and not extravagant?"

A.: "It is. It is the only way that work can be done to be done properly."

In former years complainant let several contracts for the labor of bricking some of its smaller-sized tunnels; furnishing all the vital materials, brick, cement and sand. Complainant found, however, that the contract work was not as satisfactory as it would have been if done by day's work by complainant's men. (Test. p. 702.) The letting of brick work by contract was, therefore, abandoned, and from that time all of complainant's brick work was done by bricklayers, helpers and laborers hired by complainant by the work and paid by day's work.

To show the degree of preference that complainant always had for brickwork done by the day, to brick

work done by contract, reference to Tables XIX, XX and XXI will disclose that out of twenty brick structures there enumerated only four brick work structures, according to defendants' witness, Mr. Higgins, were done by him under contract, namely: Pilarcitos tunnel No. 1, 341,000 brick; Lock's Creek tunnel No. 1, 704,000 brick; Bald Hill tunnel, 564,000 brick; Six-mile House tunnel, 430,000 brick; total, 2,039,000 brick.

As shown in Table XXII, the total number of brick required for the twenty brick structures enumerated in Tables XIX, XX and XXI amounted to 10,095,000 bricks.

The four contracts, therefore, to which Mr. Higgins testifies, represent, as to the total number of bricks laid in them, only 20 2-10 per cent, or, about one-fifth of the whole, while the remainder of nearly 80 per cent, or four-fifths, was done by day's work.

Mr. Schussler expresses this preference for day's work over contract, as follows (p. 702):

> "The construction of the works of the Spring Valley Water Company, during the past forty years, has been mostly carried on by day's work instead of contract work. We found out at an early date in the history of this company that work done by skilled and energetic workmen, if done by the day and under the supervision of competent and reliable foremen, was much more satisfactory, efficient and lasting and, in the end, was cheaper than the same work, if done by contract."

On the same page he enumerates certain structures and parts of structures, such as machinery, plate-iron, manufacturing of wrought and cast-iron pipes, water gates, fittings, etc., which for reasons there given (and as will be hereafter further detailed) were done by con-

tract, but under complainant's rigid specifications and inspection.

The following quotation from Mr. Schussler's testimony shows the division of labor in the construction of brick work in small-sized tunnels. He says (p. 2443):

"There is another thing that you must remember: bricklayers belong to unions; hod-carriers belong to unions. For instance, there is a very rigid division of the duties of a bricklayer and the duties of a hod-carrier, and you have to conform to some extent to their requests. And there being only bricklayers and hod-carriers here, so far as I can find out, who belong to these institutions, we try to come as near to their reasonable wants as we can, so that perhaps causes us to point (put) on even a little more help than we otherwise would. We cannot get the bricks laid unless it is done by men who have certain rules and certain prices per day."

X. Q. 3760: "To handle these 2,000 brick and the necessary mortar requires eight men in addition to the 5 bricklayers?"

A. "You mean hod-carriers and laboring men?"

X. Q. 3761: "Yes."

A. "That can be easily explained in this manner: At one end of a tunnel, that is, at one face of a tunnel, there are usually two bricklayers working; there are from one to two mortar-men working—sometimes one, sometimes two; when they are rushed they have two; when they are delayed by taking out timbers or for some other cause they may temporarily get along with less. With those two men who are working at one face of the tunnel we have from two to 2½ men—in this case only two men—working on the outside. That is not to say we have five men running cars into the tunnel from one end. If there are two bricklayers working at one face of the tunnel then those two bricklayers have two men that

run the cars in and out and bring the material in and out and take out the timbers. There is delay. These men help in taking out the timbers that have been put up during the drifting of the tunnel; there are all these odds and ends to be done. Calculating about two bricklayers in a shift, working a shift of 8 hours, we have two men for each bricklayer. In other work there are sometimes more helpers per bricklayer and sometimes less, changing with the difference in the work. This result is the result of a great many years of my own practical experience. I will acknowledge that I am particular and that I want good work and that I want all the brick selected and picked over. All that work goes in. If the inspector of the brickyard has by any chance passed some of the brick that are not quite first-class those are again reselected at the tunnel and overhauled again. That is the duty of the man whom I call "laborer," and that averages, as near as can be estimated, and as near as we can judge from our own experience, about one man to the bricklayer. The consequence is we get first-class work."

X. Q. 3762: "Do you take out the timbers?"

A. "Yes sir."

X. Q. 3763: "Before bricking or after?"

A. "Just before bricking."

X. Q. 3764: "What effect does that have on the earth? Does it fall in?"

A. "We have to stay it up a little. If there is any danger of caving, if that loose material comes down just then—locally—we have careful men who are accustomed to that kind of work; if the work is dangerous and risky we have extra miners constantly on hand, because if we lost one man it not only means that his life is worth a great deal to us, but the expenses incurred in paying the damages is a great deal, and we do all we can to protect the men."

Referring to the Pilarcitos tunnel, which, like all the long brick-lined tunnels of complainant "are small and

very cramped to work in" (p. 2438), and in speaking of the bricklayers' helpers, required under the conditions of 1903-04, for which period, Mr. Schussler, in his testimony, estimates the cost of reproduction by day's labor of complainant's works, he says (p. 2438):

X. Q. 3741: "What were the duties of the bricklayers' helpers in this tunnel?"

A. "I have not the detail data here, but I can tell approximately from memory. The bricklayers' helpers—the hod-carriers, as they call them—make the mortar. To every five bricklayers we average three men, called hod-carriers or mortar-men, and five laborers and car-men, who assist in getting the material into the tunnel and handing it to the men. The hod-carriers or mortar-men prepare the mortar for the bricklayers and they also attend the bricklayers in the tunnel. The way we usually made those arches was that we ran the lower half of the brick work—the lower part of the arch—ahead some distance; it being a very cramped position we would run that from 10 to 20 feet and sometimes even more, and finish up that brick work, starting in with the bottom arch in the center, the bed of the bottom arch having been prepared beforehand so as to conform exactly to a templet, the carpenter who is working around the tunnel helps to set the templets and adjust them properly for these men so as to maintain the exact size of the tunnel. While the lower 4½ inches say of the bottom arch are being laid I do not allow anybody to walk on the brick work because walking on it would disturb and break open the joints; the handing of the brick and mortar to the bricklayers is for that reason a somewhat tedious job; they are apt to lose a little time. When the second arch—that is, the upper 4½ inches is laid on the lower arch with good mortar-joint in between the two then the mortar-men keep on handing the brick to the bricklayers. Just as soon as there is width enough that the lower bottom arch can be

walked on and is safe, then by putting in some sacking or planking, or other soft material that happens to be handy, so as not to allow any walking on the new brick work, these men then standing on that lay up the rest of the arch up to the spring of the arch. Then there is about 20 or 25 feet of the bottom arch finished. We usually time that with the ending of the shift. Then come the carpenter and helper and set up the center or what we call the templet for the top arch and adjust it carefully. Then the bricklayers go on again. We do not allow any brick or mortar to be piled on this new brick work except with extreme care, and then not only but very small quantities and use planking and other material on top of the two sides of the invert arch so that the new brickwork that is just beginning to set is not disturbed. These mortar-men or bricklayers' helpers take the mortar as well as the brick from the place where the cars then have delivered it outside the invert arch and pack half a dozen or a dozen brick at a time—usually on a little plank—to the bricklayers, who lay it there so as to be handy for the work they are doing on the top arch. The mortar men are also attending to keeping them supplied with mortar. In that manner this work goes on. As you can see in a small tunnel of that kind there is more or less loss of time that cannot be avoided. The average number of brick laid in the manner that I demand, and that is our rule, does not exceed on an average in a small tunnel of this size, with a thin arch, 400 brick a day; that is a day's work. We lately had brick work done in San Francisco, in an open reservoir, and with the very particular work we did there, with a 4½ or 5 inch bed of brick, the men averaged between 450 and 500 brick a day; they were picked men and did a fair day's work. In larger tunnels we have increased frequently the number of brick that one good bricklayer can lay the brick to our satisfaction."

In regard to the dimensions of Pilarcitos tunnel No. 1, which are similar to those of most of complainant's long and small-sized tunnels, Mr. Schussler says (p. 2438):

> X. Q. 3739: "This Pilarcitos tunnel is 5½ by 6, is it not?"
>
> A. "No sir. It is 5½ feet wide at the bottom from out to out of the timber, 4½ feet at the top from out to out of the timber, and 6 feet high. Frequently when we are in rock we do not cut out all of the lower corner that would be there if you desired this shape of the tunnel, namely, 5 feet 6 at the bottom, 4 feet 6 at the top and 6 feet high. We leave then a portion of the corner standing on each side and simply set in the timbers in a notch where they come. In that way we save a great deal of excavation, and later on the replacing near the bottom. Near the top we cannot help ourselves very well. There we have to cut it out in order to get the sets of timber in about to the size as intended by these dimensions."

Regarding the labor required and performed in bricking a tunnel of this kind (outside of the work of the bricklayers and their helpers; the mortar-mixers and hod-carriers), Mr. Schussler in his testimony specifies that labor and its cost as follows (p. 773):

> "One carpenter who attends to two gangs at both ends, going backward and forward, putting in the templets for the bricklayers from the bottom arch up to the spring of the arch, and who keeps in repair and sets the templets for the top arch; he also assists in taking out the timbers. He attends to the work of 5 bricklayers who lay 2,000 brick a day. He gets $4 a day, which includes his board."

"In addition to these helpers" (referring to the mortar-men and hod-carriers) "there are 5 laboring

men and car men that bring the material in and out, carrying the timbers out in the cars and bringing the brick and mortar and cement, etc., into the tunnel. These 5 men receive $2.50 a day each, which includes their board; that makes $12.50 a day for the laborers and car men attending 5 bricklayers, laying a total amount of 2,000 brick a day" (p. 772-3).

As to the labor of the bricklayers, hod-carriers and mortar-men he says (p. 754):

"The bricklayer's wages are $6 a day; their board costs us 80 cents in addition, which board we have to furnish to them outside of their regular $6 a day when they work out in the country, making each bricklayer cost us $6.80 per day" (p. 754) * * * "each hod-carrier and mortar-man receiving $3.50 a day wages and 80 cents for board, making a total of $4.30" (p. 755).

A recapitulation of the main features of the labor cost of the bricklaying shows that the length of a day's work is eight hours, and the wages paid are: Bricklayer, $6.80 per day; hod-carrier and mortar-man, $4.30 per day; carpenters, $4 per day; laborers, $2.50 per day.

Daily Performance of Brickwork Under the Varying Conditions.

From the testimony as to the wages paid for the different kinds of labor, together with what is shown as to the average number of bricks that can be laid in a day of eight hours under the varying conditions, circumstances and degree of difficulties of work in the respective locations of the different structures, we can arrive at the cost of laying each 1,000 of bricks in each of the structures hereinbefore enumerated in Table XVIII and also mentioned in Tables XIX, XX and

XXI, and designated by the letters a, b, c, d, e, f, g, h, i, j and k.

In the following list of structures, from A to K, both inclusive (Table XVIII), those which present the greatest difficulties in the construction of the brick work, owing to the small size of the tunnels, the cramped condition under which the work has to be performed, the length of these small tunnels, or inconvenience in passing the materials to the bricklayers, requiring a greater expenditure for transportation of the materials from the outside of the tunnels to where the bricklayers are at work, than in shorter and larger tunnels, or in work performed in the open, are mentioned first in Group A. Thereafter follows, in Group B, the structures that are somewhat easier of access than those in Group A. Thereafter follows Group C, with several structures where the conditions are still more favorable than those in Group B; and, finally, in Group D, a case is given in which the work is in the open and under more favorable conditions than any of the structures in Groups A, B or C.

Mr. Schussler testified that the Lombard street reservoir in San Francisco had been very recently constructed. He had an accurate account of the work there showing that under these favorable conditions the average number of brick laid by the men in the first-class manner required for complainant's structures was between 450 and 500 a day (pp. 2440 and 2967).

This furnished one basis for estimating and comparing work done in the tunnels under more difficult conditions.

Under the present schedule of wages and hours of labor, the following estimates of the cost of the work, if now constructed, are quoted from Mr. Schussler's testimony:

GROUP A.

(Item c, Table XVIII):

PILARCITOS TUNNELS NO. 1 AND NO. 2.

(*Complainant's Test. pp.* 771-773.)

"One bricklayer lays in this small arch and narrow tunnel about 400 brick a day in the first-class shape that we get work done. The tunnel being small, the work is very cramped, and the men are likely to interfere with each other, but they have come up to 400 brick a day. The wages and board of a bricklayer—when I speak of board it means we have to board them for seven days and they do but six days' work in the week—are $6.80; dividing $6.80 by 400 and multiplying it by 1,000, gives us the cost of the bricklayer's wages and board for each thousand brick laid, or $17.

Five bricklayers can thus lay 2,000 brick in a day of 8 hours. These 5 bricklayers working in the tunnel—from 2 to 3 at each end, sometimes 3 at one face and 2 at the other and at other times 2 at one face and *3 at the other, depending on how the bottom arch is laid ahead of the top arch. These 5 bricklayers require 3 men, hod-carriers and mortar-men to attend them. Each hod-carrier and mortar-man gets $3.50 a day plus 80 cents for board, making $4.30 per man, or, for 3 men $12.90 for the hod-carriers and mortar-men to assist in the laying of 2,000 brick. Consequently, dividing $12.90 by 2 we have for the labor of these helpers, per thousand brick, $6.45.

"In addition to these helpers there are 5 laboring men and car-men that bring the material in and out, carrying the timbers out in the cars and bringing the brick and mortar and cement, etc., into the tunnel. These 5 men receive $2.50 a day each, which includes their board; that makes $12.50 a day for

* Should read 2.

the laborers and car-men attending 5 bricklayers, laying a total amount of 2,000 brick a day, $12.50 divided by 2, $6.25.

"One carpenter, who attends to the two gangs at both ends, going backward and forward, putting in the templets for the bricklayers from the bottom arch up to the spring of the arch, and who keeps in repair and sets the templets for the top arch; he also assists in taking out the timbers. He attends to the work of 5 bricklayers who lay 2,000 brick a day.

"He gets $4 a day, which includes his board.

"Dividing $4 by 2 makes $2."

By adding together the above four items of cost of mechanical, semi-mechanical and common labor, required for each 1,000 bricks, laid as above detailed, we have:

Bricklayers	$17.00
Hod-carriers and mortar-men	6.45
Carpenter	2.00
Labor	6.25
Present cost of labor per 1,000 bricks laid	$31.70

Item e, Table XVIII.

Lock's Creek Tunnel No. 1.

Dimensions and Conditions Similar to Item c.

(Test. p. 1019.)

Bricklayers, each averaging about 400 brick a day	$17.00
Hod-carriers and mortar-men	6.45
Carpenter	2.00
Laborers	6.25
Present cost of labor per 1,000 brick laid	$31.70

Item g, Table XVIII.

BALD HILL TUNNEL.

(Test. p. 864.)

As shown in subdivision f., on Table XVIII, the sand, cement and brick, delivered at the "brick shaft and inlet tunnel at San Andres reservoir, cost at the present time $26.48."

By deducting this sum of $26.48 for materials, from the total of $59 per thousand brick laid (which includes materials and labor), we have $32.52 as the cost of mechanical, semi-mechanical and common labor, required for each one thousand bricks laid, as above described and detailed in this long and small tunnel.

Item k., Table XVIII.

SIX-MILE TUNNEL.

(Test. pp. 1000-02.)

Length, between that of Pilarcitos Tunnels Nos. 1 and 2: Dimensions similar.

Bricklayers, each averaging about 400 brick a day.....	$17.00
Hod-carriers and mortar-men	6.45
Carpenter	2.00
Laborers	6.25
Present cost of labor per 1,000 bricks laid	$31.70

Item f., Table XVIII.

BRICK SHAFT AND INLET TUNNELS AT SAN ANDRES RESERVOIR.

(Test. pp. 854-5.)

"Bricklayers: One bricklayer in this work, averaging shaft, tunnel, inlets and outlets, although this work was very cramped in places, lays about 400 brick a day. Bricklayers receive $6.80, that is, $6 in money and the board costing 80 cents. Dividing that by 400, and multiplying it by 1,000 we have the cost of the bricklayers' work per thousand brick—$17; 3 hod-carriers and mortar-men for 4 bricklayers." Mortar-mixer is on top of shaft. Materials have to be lowered down to tunnel, picked up again and delivered to bricklayers. Mortar-men $3.50 a day and 80 cents for board: $4.30 a day each. 4 laborers at $2.50 a day (inclusive of board); windlass and handymen, assist bricklayers' helpers. One-half carpenter's day's work at $4 (inclusive of board), $2. One-half laborer's day's work helping carpenter with scaffolding at $2.50—$1.25—which makes for all help for 4 bricklayers laying 1,600 brick a day: hod-carriers $12.90, labor $10, carpenter $2, carpenter's helper $1.25—total $26.15 per day for 1,600 bricks laid, or per 1,000 brick, $16.35.

By adding together the above $17 for the bricklayers and the $16.35 for their helpers, consisting of mechanical, semi-mechanical and common labor, we have a total of $33.35, as the present cost of mechanical, semi-mechanical and common labor, required for each 1,000 bricks laid.

This completes Group A of complainant's brick structures enumerated in Table XVIII.

GROUP B.

Brickwork, Which is Somewhat Easier of Access and Where the Space for the work is not so Cramped or Inconvenient of access as in the Structures Mentioned in Group A.

Item j, Table XVIII.

GATE-SHAFT AND TUNNELS AT UPPER CRYSTAL SPRINGS DAM.

(Test. pp. 893-5.)

Bricklayers not being so cramped as in the somewhat smaller tunnels, heretofore detailed, can lay about 450 bricks a day. Wages and board, $6.80 per day.

This, 1,000 bricks laid, makes $15.10.

Five bricklayers require 3 hod-carriers and mortar-men, who receive $3.50 a day and board; 80 cents, or $4.30—being a total of $12.90. Divided by the day's work of 5 bricklayers, of 2,250 bricks, makes per 1,000 bricks laid, $5.73.

Four laborers assisting bricklayers' helpers, wheeling materials into tunnel, hoisting into shaft, hoisting out timbers, at $2.50 a day, making $10. Divided by 2,250 brick laid by 5 men, this makes for labor per 1,000 bricks, $4.45.

One carpenter at $4, setting templets for bottom and top arch, arranging scaffolding in shaft; divided by 2,250 bricks laid by 5 men, makes per 1,000 bricks, $1.78.

By adding together the above four items of cost of mechanical, semi-mechanical and common labor, required for each 1,000 bricks, laid as above detailed, we have:

Bricklayers	$15.10
Hod-carriers and mortar-men	5.73
Carpenter	1.78
Labor	4.45
Present cost of labor, per 1,000 bricks laid	$27.06

GROUP C.

Brickwork, Where the Conditions Are Still More Favorable Than in Group B.

Item a, Table XVIII.

PILARCITOS WASTE-WEIR, TUNNEL AND BRICK CHUTE.

(Test. pp. 754-5.)

In this structure a bricklayer lays about 500 bricks a day. Wages and board $6.80; (when working in the country, complainant furnishes the board, costing 80 cents a working day). This makes, per 1,000 bricks laid, $13.60.

Four bricklayers require 3 mortar-men and hod-carriers in this tunnel work. Wages $3.50; board 80 cents; total for the 3 men $12.90 a day. Two laborers at $2.50 a day, help the mortar-men and hod-carriers, $5. One carpenter for templet work and centers, $4 a day. Adding together $12.90, $5 and $4, makes $21.90. Divided by 2,000 bricks laid, makes the help per 1,000 bricks $10.95.

By adding together the above four items of cost of mechanical, semi-mechanical and common labor required for each 1,000 bricks laid as above detailed, we have:

Bricklayers $13.60
Mortar-mixers, hod-carriers, laborers and carpenter 10.95
Present cost of labor per 1,000 bricks laid, $24.55.

Item h., Table XVIII.

(pp. 824-5-6.)

SAN ANDRES WASTE-WEIR.

(Test. pp. 824-6.)

In this structure, a bricklayer lays about 500 brick a day. Wages and board $6.80, which makes per 1,000 bricks laid, $13.60.

Four bricklayers, attended by 3 hod-carriers and mortar-men, at $3.50 and board, or $4.30, making $12.90 a day. Three laborers assist them in running cars, piling brick, helping carpenter, setting templets and taking out timbers at $2.50, makes $7.50 a day. One carpenter at $4 a day. Adding together $12.90, $7.50 and $4 makes $24.40. Dividing this by 2,000 bricks makes for the help per 1,000 bricks laid, $12.20.

By adding together the above items of cost of mechanical, semi-mechanical and common labor, required for each 1,000 bricks, laid as above detailed, we have:

Bricklayers $13.60
Mortar-men, hod-carriers, laborers and carpenter 12.20
Present cost of labor per 1,000 bricks laid, $25.80.

Item i., Table XVIII.

GATE-SHAFT AND TUNNELS AT CRYSTAL SPRINGS MAIN DAM.

(Test. pp. 927-9.)

Bricklayers will average in the small inlet tunnels, the main tunnel and the main gate-shaft, about 500 bricks a day, which makes the cost per 1,000 bricks laid, $13.60.

Five bricklayers in this work require 3 hod-carriers and mortar-men, at $4.30, including board, makes $12.90. Five laborers at $2.50 (assisting helpers while 5 bricklayers lay 2,500 bricks), makes $12.50. One carpenter, $4, assisted by one helper at $2.50 a day, makes $6.50 a day for setting templets, centers, erecting scaffolding. This makes the total help for 5 bricklayers, $12.90, $12.50 and $6.50, or $31.90. Dividing this total for help by 2,500 brick, makes the cost of this help per 1,000 bricks, $12.76.

By adding together the above items of cost of mechanical, semi-mechanical and common labor, required

for each 1,000 bricks laid, as above detailed, we have:

Bricklayers	$13.60
Mortar-mixers, hod-carriers, labor and carpenter	12.76
Totals per 1,000 bricks laid	$26.36

GROUP D.

Brickwork, Where the Work is in the Open and the Conditions Are More Favorable Than in Any of the Structures Enumerated sub-A, B or C:

Item d. Table XVIII.

PILARCITOS STONE DAM, SMALL BRICK CAP. (Test. p. 1012.)

Mr. Schussler's estimate for 1903-04 gives no further details, except on page 1012:

"10,700 brick laid at $56 per thousand";

which (besides the cost of labor of bricklaying and help) includes all materials, as well as their transportation to and delivery at this structure.

Item b., Table XVIII.

GATE-HOUSE AT PILARCITOS TUNNEL NO. 1. BUILT IN THE OPEN. (Test. pp. 765-6).

In this work a bricklayer lays about 600 bricks a day. Wages and board, $6.80. Cost per 1,000 bricks laid, $11.33.

Five bricklayers require 3 mortar-men at $4.30, or $12.90, and 2 laborers helping mortar-men and hod-carriers at $2.50, making $5. Half a day's work of carpenter at $4, makes $2. Adding together this help for five bricklayers, $12.90, $5 and $2, we have $19.90. Dividing this by 3,000 bricks laid a day by every 5 bricklayers, makes, per 1,000 bricks laid, $6.63.

TABLE XXIII

BEING A RECAPITULATION OF MR. SCHUSSLER'S ESTIMATES FOR 1903-04, OF THE COST OF LABOR REQUIRED TO LAY 1,000 BRICKS IN THE RESPECTIVE STRUCTURES HEREIN ENUMERATED, AND UNDER THE VARYING LOCAL CONDITIONS DESCRIBED

Group of structures	Designation of structure in Table XVIII	Name of Structure	Number of bricks, that a bricklayer averages in a day of 8 hours, working by the day, doing the first-class work, laid in cement mortar, required for complainant's hydraulic brickwork	Cost of labor, per 1,000 bricks laid, for mechanical, semi-mechanical and common labor—segregated and total					REMARKS
				Bricklayers' work	Hod-carriers and mortar-men's work	Common labor	Carpenter work	Total cost of labor per 1,000 bricks laid	
A	*c*	Pilarcitos tunnels No. 1 and No. 2	400	$17.00	$ 6.45	$ 6.25	$ 2.00	$31.70	One bricklayer lays in this small arch and narrow tunnel about 400 brick a day in the first-class shape that we get our work done. The tunnel being small, the work is very cramped, and the men are likely to interfere with each other.
	e	Lock's Creek tunnel No. 1	400	17.00	6.45	6.25	2.00	31.70	
	g	Bald Hill tunnel	.....	.....	.....	.....	.....	$32.52	
	k	Six-mile House tunnel, near San Francisco County line	400	17.00	6.45	6.25	2.00	31.70	
	f	Brick-shaft and inlet tunnels at San Andres reservoir	400	17.00	16.35			33.35	
B	*j*	Gate-shaft and tunnels at Upper Crystal Springs dam	450	15.10	5.73	4.45	1.78	27.06	The bricklayers in this tunnel were not cramped quite as much as in the somewhat smaller tunnels that I have detailed before.
C	*a*	Pilarcitos waste-weir	500	13.60	10.95			24.55*	
	h	San Andres waste-weir	500	13.60	12.20			25.80*	
	i	Gate-shaft and tunnels at Crystal Springs main dam	500	13.60	5.16	5.00	2.60	26.36*	
D	*d*	Pilarcitos stone dam, *small brick cap*	.....	Note—Cost of labor is included in total cost per 1,000 bricks. (see (p. 1012)					This work being done in the open gave more freedom to the men in doing the work.
	b	Gate-house at Pilarcitos tunnel No. 1	600	11.33	6.63			17.96	

*In this class of work, a bricklayer averages about 500 brick a day, laid in first-class manner, in cement mortar, the tunnels being generally larger and the work somewhat more accessible than sub. *B*.

That under present, and the respective local conditions, the daily performance of a good bricklayer of laying 450 and 500 bricks a day, in very important and first-class hydraulic brickwork, of the class and character constructed by complainant—is placed rather high, for the tunnel and shaft-work enumerated in groups *B* and *C*—is shown by the fact that in an open and very accessible brickwork reservoir, reconstructed of late by complainant—(with union labor, under union wages and conditions, working eight hours a day)—the first-class bricklayers employed averaged between 450 and 500 brick a day, as heretofore quoted from pages 2967 and 2440 of complainant's testimony, which reads as follows:

> Page 2967—"The only portion of any reservoir that I have an accurate cost account is of the late work we did at the Lombard Street reservoir."
>
> Page 2440—"We lately had brickwork done in San Francisco, in an open reservoir, and with the very particular work we did there"—as we do in all our work—"with a 4½ or 5-inch bed of brick, the men averaged between 450 and 500 brick a day; they were picked men and did a fair day's work."

This daily performance, in an accessible, open reservoir, of between 450 and 500 bricks to a bricklayer's day's work, also shows that the 400 brick per bricklayer per eight-hour day, in the long, small, cramped tunnels, enumerated sub. *A*—is a fair average day's work.

TABLE XXIV

BEING A RECAPITULATION OF THE PRESENT COST OF MATERIALS, PER 1,000 BRICKS LAID, DELIVERED AT THE RESPECTIVE STRUCTURES (ENUMERATED IN TABLE XVIII), AND THE COST, (PER 1,000 BRICKS LAID) OF ALL MECHANICAL, SEMI-MECHANICAL AND COMMON LABOR REQUIRED, UNDER THE VARYING CONDITIONS PRESENTED BY THE RESPECTIVE LOCALITY, SURROUNDINGS AND CIRCUMSTANCES, IN AND UNDER WHICH THE WORK HAS TO BE PERFORMED

Group of structures see Table XXIII	Designation in Tables XVIII and XXIII	NAME OF STRUCTURE	TOTAL COST (exclusive of incidental, contingent, engineering and superintending expenses) of				REMARKS
			MATERIALS sand cement and brick delivered at the respective structures, see Table XVIII	LABOR mechanical, semi-mechanical and common; bricklayers, hod-carriers, mortar-men, carpenter and laboring men, see Table XXIII	COST PER 1,000 BRICK LAID, inclusive of all materials delivered at the respective structures, and inclusive of all labor required during construction of work in place	TOTAL COST PER 1,000 BRICK LAID, ROUNDED OFF TO (see respective page of complainant's testimony)	
	c	Pilarcitos tunnels No. 1 and No. 2	$31.58	$31.70	$63 28	$63.00 (p. 773)	
	e	Lock's Creek tunnel No. 1	34.51	31.70	66.21	66.00 (p. 1019)	
A	*g*	Bald Hill tunnel	26.48	32.52	59 00	59.00 (p. 864)	What has been stated in Table XXIII, and under the head of "Remarks" there, regarding the daily performance as well as the cost of all labor connected with the construction in place of the various brick structures therein enumerated, also holds good in this table.
	k	Six-mile House tunnel, near San Francisco County line	26.35	31.70	58 05	58.00 (p. 1002)	
	j	Brick shaft and inlet-tunnels at San Andreas reservoir	26.48	33.35	59 83	59.00 (p. 855)	
B	*j*	Gate-shaft and tunnel at Upper Crystal Springs dam	27.59	27.06	54 65	54.50 (p. 895)	
	a	Pilarcitos waste-weir	31.58	24.55	56.13	56.00 (p. 755)	
C	*h*	San Andreas waste-weir	26.48	25.80	52 28	52.00 (p. 827)	
	i	Gate-shaft and tunnels at Crystal Springs main dam	26.25	26.36	52 61	52.50 (p. 939)	
D	*d*	Pilarcitos stone dam, *small brick cap*	All materials—sand, cement and brick, as well as all labor of handling brick and mortar, bricklaying and other labor, is included)		56 00	56 00 (p. 1012)	
	b	Gate-house at Pilarcitos tunnel No. 1	$31.58	$17.96	49 54	49.00 (p. 766)	

By adding together the above items of cost of mechanical, semi-mechanical and common labor required for each 1,000 brick laid, as above detailed, we have:

Bricklayers	$11.33
Mortar-mixers, hod-carriers, laborers and carpenter	6.63
Present cost of labor per 1,000 brick laid	$17.96

The results as to the cost of labor for bricklaying for each 1,000 brick in these different groups of structures are recapitulated on the following Table XXIII and the results as to the cost of each 1,000 bricks laid, including both cost of material and cost of labor are combined and recapitulated in the succeeding Table XXIV:

Regarding the cost of labor of laying 1,000 brick, as shown in the foregoing Tables XXIII and XXIV, it will be seen that the cost of labor per 1,000 bricks laid decreases with the lessening of the difficulties encountered in the work, caused by the location, surroundings, dimensions and circumstances in and under which the work has to be performed.

As shown in both Tables XXIII and XXIV, the most difficult and, as a consequence, the most costly work (per 1,000 bricks laid) is comprised in the structures enumerated in group A of both tables, where the cost of labor per 1,000 bricks laid in these five structures averages $32.19.

The next four structures, presenting less difficulties in their construction and thus causing less expense for this labor, than the preceding five structures, are comprised in the two groups B and C, where the cost of labor per 1,000 bricks laid averages $25.94.

Of the two structures next following, in group D, only the second one (b) has full details given regarding the cost of labor. In this structure (as well as d), both of which are in the open and present the least difficulty in construction, compared with groups B and C, and particularly with group A, the cost of labor per 1,000 bricks laid, is only $17.96.

By comparing the average cost of labor, required for the structures in Group A, of $32.19 per 1,000 brick laid, with the average cost of labor in the structures comprised in Groups B and C, of $25.94, it will be seen that the cost of the latter per 1,000 bricks laid, on account of the more favorable conditions and circumstances, represents only 80½ per cent of the cost of the former. Comparing the average cost of the structures in Group A, of $32.19, with the cost per thousand

TABLE XXV

RECAPITULATION OF BRICK STRUCTURES, HERETOFORE ENUMERATED AND DESIGNATED WITH LETTERS FROM *l* TO *x*, IN ADDITION TO THOSE CONTAINED IN TABLE XXIV.

Class of brick work	Page of testimony	Designation in above text and tables	Name of Structure	Length of structure where given, in feet	Total number of brick required	Estimated Cost of brickwork (exclusive of incidental, contingent, engineering and superintending expenses)	Cost per 1,000 brick laid, (exclusive of incidental, etc., expenses).	REMARKS
Brick work in tunnels	990–5	l	First pressure tunnel on Crystal Springs pipe-line (San Bruno mountains, San Mateo Co.).....	300	90,000	$5,670	$63.00	Materials delivered, $25.72. Labor 37.32. (For details see pages 991 to 995 of complainant's test.)
	1499–1500	m	2d and 3d pressure tunnels on 44″ pipe, at Bernal Heights.....	1,345	403,500	22,500	55.75	Two tunnels { 225 feet and 1,120 feet in length. Shorter haul for bricking materials, complainant did not board men.
	790–796	(XIX) n	Lake Honda tunnel.....	2,820	564,000	31,020	55.00	Materials delivered: $23.47. Labor: 31.70. (For details see pages 791 to 796). Note: Sand close at hand.
	1240	(XIX) o	Lake Merced drainage tunnel.....	3,050	1,244,000	63,400	51.00	Sand close at hand.
	1256	(XX) p	Tunnel, and gate-well between north and south Lake Merced.....	....	65,700	3,080	47.00	Work more accessible than item o. Sand close at hand.
	1353–4	(XX) q	Lake Honda sewer tunnel..	2,500	480,000	20,160	42.00	Work more accessible than item p. Sand close at hand.
	1353	r	Upper brick outlet tunnel, Lake Honda, between forebay and gate-well....	187	56,000	2,520	45.00	In drifted tunnel. Sand close at hand.
	1354–5	s	Lake Honda (lower) outlet drain tunnel.....	750	157,000	7,850	50.00	Tunnel small and cramped; Sand close at hand.
Brickwork in the open	1236–7	(XXI) t	Lake Merced drainage canal.....	3,840	480,000	20,640	43.00	Work more accessible than in items v, w and x. Sand close at hand.
	1352–3	(XXI) u	Lake Honda reservoir.....	....	868,000	33,800	39.00	Roads for hauling better than sub. item t. Sand close at hand.
	1404	(XXI) v	Lombard Street reservoir...	....	346,000	17,300	50.00	*Actual cost* of brickwork lately constructed (rounded off) (exclusive of incidental, contingent, etc., expenses). See quotations on pages 2967 and 2440, heretofore quoted in text, and in table XXIII.
	1424	(XXI) w	Potrero Heights reservoir..	....	162,000	8,100	50.00	Conditions similar to those of item v.
	1415–1416	(XXI) x	Francisco Street reservoir..	....	464,000	23,200	50.00	Conditions practically identical with those of item v.

bricks laid in structure b in Group D, of $17.96, which was constructed in the open and under favorable surrounding conditions, it will be seen that the latter cost per 1,000 bricks laid represents only 55 7-10 per cent of the cost of the former.

It is thus shown that owing to the more favorable conditions and circumstances under which the structures in Groups B and C are erected, when compared with those in Group A, there is a saving of 19½ per cent in the cost of labor per 1,000 bricks laid, while, with brick laid in the open (like structure b in Group D) and under more favorable conditions than those in Groups B and C, there is a saving over the average cost of labor per 1,000 bricks in Group A, of 44 3-10 per cent.

Tables XVIII, XXIII and XXIV, as shown, give the cost for 1903-04, per 1,000 bricks laid, for eleven of complainant's brick work structures, designated with letters from a to k, both inclusive.

Besides these eleven structures, there were enumerated nine additional structures, to wit:

In Table XIX: o. Lake Merced drainage tunnel; n. Lake Honda tunnel.

In Table XX: p. Tunnel and gate-well between North and South, Lake Merced; and q. The Lake Honda sewer tunnel.

In Table XXI: t. Lake Merced drainage canal; u. Lake Honda Reservoir.

In Table XXI: v. Lombard street reservoir; w. Potrero Heights reservoir; x. Francisco street reservoir.

Besides these additional brick structures enumerated in Tables XIX, XX and XXI, Mr. Schussler's testimony gives further estimates of cost of reproduction of other structural works which are enumerated in the following Table No. XXV and are therein designated by the letters l, m and r, s.

In this Table XXV, for all the items from l to x (not shown in Table XXIV) the estimate of cost of present reproduction is given in such sequence, that the tunnel brickwork from l to s is given first, and is then followed by the brick structures from t to x, which are constructed in the open, being canal and reservoir work.

In two of the thirteen cases in the Table, namely l and n, the detailed cost estimates of the brick work in brick-lined tunnels are given.

In the eleven remaining cases the number of brick as well as the cost per 1,000 laid are given.

TUNNEL WORK.

(l.) First Pressure Tunnel on the Crystal Springs Pipe Line.

This tunnel is in San Bruno Mountains, San Mateo County, where the 44-inch Crystal Springs pipe was bricked into the tunnel for the entire length of the latter. (Test. pp. 990-5.)

Length of this tunnel, 300 feet; total number of brick, 90,000; cost of materials and labor for brick work, $63 per 1,000 bricks laid.

Details of cost of this brick work, per 1,000 brick:

Materials Delivered:

Brick delivered at South San Francisco, $11 per 1,000 bricks; loading and unloading and hauling to tunnel, $4.37 per 1,000 bricks; cement delivered at tunnel, $7.50 per 1,000 bricks; sand delivered at tunnel, $2.85 per 1,000 bricks. Total materials delivered at tunnel, $25.72 per 1,000 bricks.

Labor of Laying the Brick in the Pressure Tunnels:

This work, owing to the circumstances and the delay caused by the alternating between the boilermakers and bricklayers is very expensive. The boilermakers put into the tunnel and connected up single courses of the pipe at a time, of a length of between four and five feet only. The boilermakers then gave way to the bricklayers, who came in with their materials and laid in cement mortar the bottom arch underneath and around the sides of this short piece of pipe, and thereafter constructed the arch over the top of the same, thus completely enclosing the latter in brick work. The brickmakers retreated then and made way again for the boilermakers for the connecting of the next length of four or five feet of pipe, and so on, until the tunnel was completed. Owing to the unavoidable loss of time and the great inconvenience under which the bricklayers and their helpers have to work, this class of brickwork is very expensive, a bricklayer, under these physical circumstances, while doing first-class work, averaging about 300 bricks in the present labor day of 8 hours.

This work is detailed on page 991 of complainant's testimony. Regarding the net length of each course in the Crystal Springs 44-inch pipe line, Mr. Schussler says, pp. 981-2:

> "a plate 44 inches wide, 143 inches long, forms what we call the big or outer course of the pipe after proper allowance of lap in the straight seam; another course 44 inches wide and 142 inches long forms the inner course."
>
> "The rivets are put in the metal 7-8 inch from the edge of the round seam, that is, the center of the rivet holes, thus giving each plate although 44 inches in width, (the width eventually running longi-

tudinally with the pipe), a net width of only 42 1-4 inches to the plate."

The work of bricklaying, under these circumstances, is given in Mr. Schussler's estimate, under the schedule of wages and other conditions now prevailing, as follows (pp. 994-5):

Bricklayers, per 1,000 brick	$22.66
Hodcarriers, mortar-men and laborers, per 1,000 bricks	11.33
Carpenter, per 1,000 bricks	3.33
	$37.32
As heretofore shown, we had:	
Material, per 1,000 brick	$25.72
To which add labor per 1,000 brick	37.32
Total, per 1,000 brick	$63.04

rounded off to $63.00 per 1,000 brick laid.

(m.) Second and Third Pressure Tunnels on Crystal Springs 44-inch Pipe-line (Through Bernal Heights).

(Test. pp. 1499-1500.)

Lengths of tunnels, 225 feet and 1,120 feet; total length, 1,345 feet; number of brick required in both tunnels combined, 403,500. Bricking pipe solid in tunnel, inclusive of all material, labor, help, etc., $22,500.

By dividing $22,500 by the above number of thousands of bricks required, we have $55.76, or, in round figures, $55.75, as the cost of materials and labor per 1,000 bricks laid in these tunnels. The haul for materials was shorter, and as the work was in San Francisco, complainant did not board the men, which, in work in the country, adds 80 cents a day each to cost of day's work of bricklayers, mortar-men and hodcarriers.

(n.) Lake Honda Tunnel.

(Test. pp. 790-796.)

Length, 2,820 feet; total number of brick, 564,000; cost per 1,000 bricks laid, $55.

This total of $55 per 1,000 bricks laid is composed of the following items:

Brick delivered at Ocean View, per 1,000 bricks	$11.00
Loading at Ocean View and unloading brick at tunnel, per 1,000 brick	.62
Hauling brick to tunnel, per 1,000 bricks	4.00
Cement, delivered at tunnel, per 1,000 bricks	7.50
Sand, delivered at tunnel, per 1,000 bricks.	.35
Total cost of materials, delivered at tunnel, per 1,000 bricks	$23.47
Labor of laying brick, per 1,000 brick:	
Bricklayers, laying 400 brick in a day of 8 hours in this narrow and small tunnel, per 1,000 bricks	$17.00
Hodcarriers and mortar-men, per 1,000 brick	6.45
Carpenter, per 1,000 bricks	2.00
Laborers, per 1,000 bricks	6.25
Total cost of labor, per 1,000 bricks	$31.70

This makes for the Lake Honda tunnel, for material and labor, per 1,000 bricks laid:

For materials	$23.47
For labor	31.70
Total, per 1,000 bricks laid	$55.17

which has been rounded off to $55 per 1,000 bricks laid.

(o.) Lake Merced Drainage Tunnel.

(p. 1240.)

This tunnel, being bricked through a broad, sandy ridge, saturated with water, caused delay and extra

expense. This extra expense is more than offset by the fact that the tunnel is somewhat larger and the arch thicker than in the five tunnels, c, e, g, k and f (Tables XXIII and XXIV), and that the sand is close at hand, while in the other five cases it has to be hauled long distances.

Length of tunnel..... 3,050 feet;
Total number of brick.....1,244,000;
Estimated cost complete (exclusive of incidentals, etc.) "inclusive of hauling, cement, bricklayers' wages, board, hod-carriers, helpers, labor, pumping ..... $63,400."

Cost per 1,000 bricks laid $63.400 divided by 1.2444, equals $50.96, or, in round figures, $51 per 1,000 bricks.

(p.) Tunnel and Gate-well Between North and South Lake Merced.

(p. 1256.)

Number of brick laid.....65,700;
Estimate of cost.....$3,080.

which makes the cost per 1,000 bricks laid, inclusive of materials and labor, $46.88, or, in round figures, $47.

Note: Work more accessible than that in item o., also sand close at hand.

(q.) Lake Honda Sewer Tunnel.

(pp. 1353-4.)

Length, about 2,500 feet; number of brick required, 480,000; estimated cost of brickwork, $20,000, being, in round figures $42 per 1,000 bricks laid.

Note: Work more accessible than that in item p., also sand close at hand.

(r.) Brick Outlet Tunnel, Lake Honda (Upper Tunnel), Between Forebay and Gate-well.

(p. 1353.)

Length of tunnel, 187 feet; number of brick required, 56,000; estimated cost of brick work, $2,520; cost per 1,000 bricks laid, $45.

Note: Sand close at hand.

(s.) Lake Honda (Lower) Outlet Drain Tunnel.

(pp. 1354-5.)

Length of tunnel, 750 feet; number of brick required, 157,000; estimated cost of brickwork, $7,850; cost of brickwork, per 1,000 bricks laid, $50.

Note: Sand convenient; tunnel small and cramped.

BRICK WORK IN THE OPEN.

(t.) Lake Merced Drainage Canal.

(pp. 1236-7.)

Length of canal, 3,840 feet; number of brick required, 480,000; cost estimate of all materials and labor connected with brick work, $20,640, which makes the cost per 1,000 bricks laid $43.

Note: Work more accessible than in items v., w. and x.; sand close at hand.

(u.) Lake Honda Reservoir.

(pp. 1352-3.)

Number of brick required, 868,000; cost estimate of all materials and labor connected with this brick work, $33,800; cost per 1,000 bricks laid, $39.

Note: Roads for traveling better than sub. item t.; sand close at hand.

(v.) Lombard Street Reservoir.
(p. 1404.)

As heretofore shown, Mr. Schussler says in reference to the brick work in this Lombard street reservoir:

"The only portion of any reservoir that I have an accurate cost account of is the late work we did at the Lombard street reservoir" (p. 2697).

"We lately had brick work done in San Francisco, in an open reservoir, and with that very particular work we did there" (as we do all our brick work) "with a 4½ or 5 inch bed of brick the men averaged between 450 and 500 brick a day; they were picked men and did a fair day's work" (p. 2440).

Number of brick required for reservoir, forebay and tunnel, 346,000; cost, $17,300; cost per 1,000 bricks laid, $50.

(w.) Potrero Heights Reservoir.
(p. 1424.)

Number of brick required, 162,000 (including 20,000 in tunnel); cost estimate, $8,100, which gives cost per 1,000 bricks laid, $50.

(x.) Francisco Street Reservoir.
(pp. 1415-6.)

Number of brick required, 464,000; cost estimate, $23,200; cost per 1,000 bricks laid, $50.

The following Table XXVI combines and recapitulates the results as to the cost of brick work in all the 24 structures enumerated and designated in Table XXV and the preceding tables and therein designated with the letters a to x, inclusive.

TABLE XXVI

Shows cost of reconstruction, in 1903-04, per 1,000 bricks laid (exclusive of incidental, contingent, engineering and superintending expenses) in the 24 brickwork structures of complainant, herein enumerated, and constructed for *hydraulic purposes* with *first-class materials and workmanship*. This table also shows the number of brick required for each structure. For 12 of the structures enumerated, this table shows the respective costs of materials and labor *segregated*. While for the 12 remaining structures, the cost of material and labor, taken from the testimony, is combined. The great variation in the cost of *materials delivered*, as well as of labor *performed*, and also of the aggregate *cost per* 1,000 *bricks laid* in these 24 structures, shows to what extent, the many varying conditions and circumstances, under which these different structures are erected, influence the cost of the same.

Number of Table	Designation of structure	NAME OF STRUCTURE	Cost per 1,000 bricks laid segregated in Mr. Schussler's testimony, for twelve structures, into:		Cost per 1,000 bricks laid inclusive of all materials delivered at the respective structures, and inclusive of all labor required during construction work in place (rounded off)	Number of bricks required for structure	
			Cost of all materials, delivered at respective structures	Cost of all labor, required during construction		Table	Number of Bricks
XXIV	*e*	Lock's Creek tunnel No. 1	$34.51	$31.70	$66.00	XIX	704,000
XXIV	*c*	Pilarcitos tunnels Nos. 1 and 2	31.58	31.70	63.00	XIX	No. 1: 341,000 No. 2: 752,000
XXV	*l*	First pressure tunnel, on Crystal Springs pipe-line (San Bruno mountains, San Mateo County)	25.72	37.32	63.00	XXV	90,000
XXIV	*g*	Bald Hill tunnel	26.48	32.52	59.00	XIX	564,000
XXIV	*f*	Brick sbaft and inlet tunnel at San Andres reservoir	26.48	33.35	59.00	XIX	245,000
XXIV	*k*	Six-mile House tunnel, near San Francisco County line	26.35	31.70	58.00	XIX	430,000
XXIV	*a*	Pilarcitos waste-weir	31.58	24.55	56.00	XX	305,600
XXIV	*d*	Pilarcitos stone dam, *small brick cap*	Not segregated in testimony, $56.60		56.00	XXI	10,700
XXV	*m*	Second and third pressure tunnels on 44″ pipe, at Bernal Heights	Not segregated in testimony, $55.76		55.75	XXV	403,500
XXV	*n*	Lake Honda tunnel	23.47	31.70	55.00	XIX and XXV	564,000
XXIV	*j*	Gate-shaft and tunnel at Upper Crystal Springs dam	27.59	27.06	54.50	XX	352,000
XXIV	*i*	Gate-sbaft and tunnels at Crystal Springs main dam	26.25	26.36	52.50	XX	940,000
XXIV	*h*	San Andres waste-weir	26.48	25.80	52.00	XX	696,000
XXV	*o*	Lake Merced drainage tunnel	Not segregated in testimony, $51.00		51.00	XIX and XXV	1,244,000
XXV	*s*	Lake Honda (lower) outlet drain-tunnel	Not segregated in testimony, $50.00		50.00	XXV	157,000
XXV	*v*	Lombard Street reservoir	Not segregated in testimony, $50.00		50.00	XXI and XXV	346,000
XXV	*w*	Potrero Heights reservoir	Not segregated in testimony, $50.00		50.00	XXI and XXV	162,000
XXV	*x*	Francisco Street reservoir	Not segregated in testimony, $50.00		50.00	XXI and XXV	464,000
XXIV	*b*	Gate-house at Pilarcitos tunnel No. 1	31.58	17.96	49.00	XXI	80,500
XXV	*p*	Tunnel and gate-well between North and Soutb Lake Merced	Not segregated in testimony, $46.88		47.00	XX and XXV	65,700
XXV	*r*	Upper brick outlet tunnel, Lake Honda, between fore-hay and gate-well	Not segregated in testimony, $45.00		45.00	XXV	56,000
XXV	*t*	Lake Merced drainage canal	Not segregated in testimony, $43.00		43.00	XXI and XXV	480,000
XXV	*q*	Lake Honda sewer tunnel	Not segregated in testimony, $42.00		42.00	XX and XXV	480,000
XXV	*u*	Lake Honda reservoir	Not segregated in testimony, $39.00		39.00	XXI and XXV	868,000
					Total number of bricks required for tbe above twenty-four brick structures, designated by letters from *a* to *x*		10,801,000

REMARKS

The cost of brick per thousand and of cement per barrel, delivered at the respective *distributing centers* for *all* the twenty-four structures enumerated in Table XXVI, *is uniform.*

The cost of hauling brick and cement and delivering tbem to the *more distant* structures, located in the steep peninsular mountain regions (sucb as: a, b, c, d and e) *is greater* than the cost of hauling and delivery to *other* structures which are nearer to and more accessible from the respective *distributing centers* (sucb as: f, g, h, i, j, l, etc.)

The cost of *sand* per *cubic yard* and per *thousand brick laid*, is *uniform*, delivered at the respective *distributing centers*, at which it is loaded on wagons to be hauled and delivered to the structures in San Mateo County, designated in Table XXVI by letters a, b, c, d, e, f, g, h, i, j.

The cost of *hauling the sand* from these distributing centers, and of delivering it to the structures, a, b, c, d, e, is also (like that of the brick and cement) *greater* than to the other structures, such as f, g, h, i, j.

The *cost* of hauling and delivering *sand* from the nearest available respective source to structures, k, l, m, v, w and x—owing to the length of haul to these structures and to the grades to be overcome—is considerably greater, than in tbe cases, *where the sand is close at hand* to the structures, such as *n* (where the sand delivered costs but 35 cents per 1,000 bricks laid, see page 794), o, p, q, r, s, t and u.

The cost per thousand bricks laid of mechanical, semi-mechanical and common labor, required in the construction of complainant's first-class quality of brickwork (as fully detailed and shown in Table XXIII, and as also shown in Table XXVI), varies greatly with the conditions and circumstances under which the work has to he performed.

In every one of the above 24 structures, not only the varying cost of material delivered to them, but also the varying cost of all labor (mechanical, semi-mechanical and common) performed under all the varying conditions and circumstances, have been duly and fully considered and taken cognizance of by Mr. Schussler, in making his estimates of present cost, as given in his testimony and as herein tabulated.

Thus,—the *cost per thousand bricks laid*, as shown in Table XXVI,—shows *for each separate structure*, what this work will cost to reproduce, at the present time, with the same grade and class of materials as employed in the original construction, with first-class workmanship, and constructed under the present conditions of labor, length of day's work, and performance of work per hour.

As shown in the foregoing Table XXVI, there are twelve items of structures where the cost of materials and labor is segregated. According to the location of the respective structures, their accessibility from distributing centers for the hauling and delivery of materials, and to other attending conditions and circumstances the cost, per 1,000 bricks laid, of materials delivered at the structures, varies between a minimum of $23.47 (in n.) to a maximum of $34.51 (in e.), the maximum exceeding the minimum by 47 per cent.

The cost of labor, per 1,000 bricks laid, of constructing the brick work in place, according to whether the work is constructed in the open, with ample room and freedom of access, or in the cramped condition, varies, in these twelve segregated structures, from a minimum of $17.96 (in b.) to a maximum of $37.32 (in l.), the maximum exceeding the minimum by 107 8-10 per cent.

The combined cost of the brickwork, per 1,000 bricks laid, including the cost of all materials delivered at the respective structures, and the cost of all labor required in the construction in place, of the brick work, (in the twenty-four items shown in Table XXVI, varies from a minimum of $39 (in u.) to a maximum of $66 (in e.), the maximum exceeding the minimum by fully 69 per cent.

In all cases Mr. Schussler's estimates here analyzed refer to the cost of reproduction in 1903-04. As shown in his testimony, the conditions under which the work would have to be done in 1903-04 differ in many respects from those existing at the time when most of the brick work was constructed. The cost of materials, as well as of labor, have changed materially since then. Where certain classes of materials are cheaper now than formerly, others are dearer. The most important

changes are in the item of labor in which there has been a material increase in the rates of the day's pay for all classes of labor required, but a material reduction in the number of hours constituting a day's work.

This increase in cost of labor has resulted in very materially increasing the cost of reproduction over the cost of original construction of nearly all of complainant's constructed works; the prominent exceptions being the new Alameda 54-inch pipe, the brickwork in the Lombard street reservoir, and a small amount of main pipe laying in San Francisco, which latter three items of work were constructed since the present schedule of higher wages for labor and hours of labor were adopted and put in operation.

XV.

Mr. Higgins' Testimony.

Analysis of His Facts and Figures on Brick Work Shows Them to Be Wholly Unreliable.

Defendants' witness regarding complainant's brick work—outside of Mr. Carey and Mr. Fifield, who testified as to hauling materials to some of complainant's brick structures—is Mr. Higgins.

He states that he worked as a journeyman on the Lake Honda reservoir in 1867 and also worked at College Hill reservoir by day's work in 1870-71. He also worked as contractor on the brick work of four tunnels from 1870 to 1883. These are the tunnels designated in Table XXVI of this brief by letters g, c (Pilarcitos tunnel No. 1), e and k. During the same period, from 1870 to 1883, he was hired as foreman to do brick work by day's work on the original San Andres brick waste-weir; and when this waste-weir was extended to its

present length, in 1887, he again acted as bricklayers' foreman (h, Table XXVI). The last piece of contract brick work was done in 1883, which, as shown in Mr. Higgins' testimony, was the bricking of the six-mile tunnel. After 1883, he was engaged as foreman for starting the brick work in the Bernal tunnels in 1884 (m, in Table XXVI); at a short tunnel at Sierra Point in 1886; and on that part of the present tunnels and gate-shaft at the main Crystal Springs dam, which was constructed in 1887-8.

The year 1883 had terminated the employment of Mr. Higgins as contractor for any of its hydraulic brick work, and the year 1887-8 was the last year in which complainant employed him as foreman of bricklayers on any of its hydraulic brick work.

The four structures on which Mr. Higgins says he worked by contract are: Bald Hill tunnel (g.), Pilarcitos tunnel No. 1 (c.), Lock's Creek tunnel No. 1 (e.), and Six-mile House Tunnel (k.).

These four tunnels require the following number of brick respectively; g: 564,000 bricks; c: 341,000 bricks; e: 704,000 bricks; k: 430,000 bricks, being a total of 2,039,000 bricks laid by contract during the period from 1870 to 1883, both inclusive.

During the period from 1865 to 1883, both inclusive, complainant constructed by day's work eleven hydraulic brick work structures, namely u, q, s, x, c, a, b, f, n, j and about one-half of h (Table XXVI), which day's work structures, in round figures, required 4,600,000 bricks.

Out of the total number of twenty-six hydraulic brick work structures enumerated in Table XXVI, representing most of complainant's brick structures erected between 1865 and 1903-04, and requiring a

total number of 10,801,000 bricks, only four structures (as shown) were constructed by contract, representing a total number of 2,039,000 bricks, or only 18 87-100 per cent of all the brick laid.

Mr. Higgins, as witness for defendant regarding brick work done by him for complainant, either as contractor or working by day's work, testified mostly from memory as to what he recollects about cost and performance of labor. Of the four small tunnels which he states he bricked by contract three of them, the Bald Hill tunnel, Pilarcitos tunnel No. 1 and Lock's Creek tunnel No. 1 were between 1870 and 1872 (or about thirty years before) and the Six-mile House tunnel was constructed in 1883, or fully twenty years before. As to the first three Mr. Higgins depends upon his memory, while for the fourth one he partly uses his memory and opinion, and partly refers to a contract for bricking under the conditions ruling in 1883.

The three structures built by day's work on which he says he worked as foreman are the San Andres waste-weir, the Bernal tunnel and the brick shaft and tunnels at Crystal Springs main dam. As to these he depends principally upon his memory and opinion, and, in two cases, he gives some figures regarding the quantity of brick work and his idea of the cost of the same.

Regarding the San Andres waste-weir (which was entirely done by complainant by day's work, the main or inlet portion in 1874-5, and the outlet portion, or extension of the main portion, in 1887), Mr. Higgins gives his opinion from his memory.

As to the Bernal tunnels, Mr. Higgins says, on page 24 of defendant's testimony, that he was employed on this extensive work only for 20 days; that he "only started it" and that he did not finish it.

As to the last of the above three hydraulic brick work structures, the gate-shaft and tunnels at the main Crystal Springs dam, Mr. Higgins says he worked for complainant as foreman during 1887, but he did not complete the gate-shaft up to its present height. The latest addition to the gate-shaft, made by complainant during the year 1890 (when it raised the height of the main dam by 30 feet), was also thirty feet in height, so as to correspond with the raising of the dam; but, as shown by his own testimony (p. 39), this was not done under Mr. Higgins as foreman, but under another foreman.

The number of brick contained in this addition of 1890 are included in Mr. Schussler's total number of 940,000 brick (Complainant's Test. p. 925), which the latter gives for the entire structure, as it now exists. The bricks in the 30 feet addition to the gate-shaft (which were laid 2 years after Mr. Higgins had been connected with this lower portion of this outlet gate-shaft and tunnel work), were consequently not included in the brick work of that portion for which he acted as foreman in 1887, and in regard to which he testified in this case.

The testimony in this case does not give the number of brick in this last addition, made in 1890, to the Crystal Springs gate shaft; but from various data given, this number can be ascertained with sufficient accuracy. The height of the addition made to the dam in 1890 was thirty feet or ten yards. Exhibit 49, filed in this suit, shows the dimensions of the shaft. The shaft has a clear inside diameter of 14 feet all the way up; the thickness of the wall at the bottom of this latest addition (thirty feet below its present top) measures 3 6-10 feet or 1 1-5 yards, while the thickness of the

wall, at the top of this latest addition measures three feet or one yard. These dimensions give the cubical contents of the brick work in this addition at fully 199 cubic yards, or, in round figures, 200 cubic yards.

Mr. Higgins gives the dimensions of bricks, as taken from complainant's hydraulic brick work specifications, as 8 inches by 4 inches by 2½ inches (Defendants' Test. p. 21). These dimensions give the cubical contents of a brick as 80 cubic inches. As a cubic yard contains 46,656 cubic inches, it would take 583 brick to make a cubic yard, if no allowance were made for space for the mortar joints. In first-class hydraulic brick work, a cubic yard of brick masonry averages between 400 and 460 bricks (laid in cement mortar) per cubic yard of masonry. In the case of complainant's hydraulic brick masonry, where the cement mortar joints are generally much thinner than in ordinary brick work, the number of bricks laid in a cubic yard of its high grade of hydraulic masonry is nearer 460 than 400. But to be on the safe side (in estimating the number of bricks in the Crystal Springs gate-shaft which were not laid by Mr. Higgins), we will assume the low figure of about 400 brick to the cubic yard of brick work, which, for the cubical contents of the same, of about 200 cubic yards, makes a total, in round figures, of 80,000 bricks, contained in this latter addition. By deducting this number of 80,000 bricks from the total number of brick contained in the entire present gate-shaft and inlet and outlet tunnels, as shown on page 925 of Mr. Schussler's testimony, of 940,000 bricks, we have for the work, on the construction of which Mr. Higgins acted as foreman in 1887, 940,000 less 80,000, or 860,000 bricks.

With these preliminary observations we will now

take up in their order the four structures on which Mr. Higgins says he did brickwork by contract, as to which it must be remembered that complainant selected and furnished all materials, such as sand, cement and brick at its own expense.

1. Bald Hill Tunnel.

(g., in Table XXVI of This Brief.)

What is Shown by Mr. Higgins' Testimony as to the Contract Work on This Structure.

The tunnel was constructed in 1870; length of tunnel, 2,820 feet (Complainant's Test. p. 864); number of bricks required, 564,000 (Our Table XIX).

Mr. Higgins' testimony as to this tunnel (Defendants' Test. p. 3) shows in substance:

Tunnel bricked in 1870; length of tunnel about 2,800 feet; complainant furnished sand, cement and brick; contractor provided tools, candles, labor and board for himself and men, at $15 per 1,000 bricks laid. Tunnel was to contain 205 bricks per lineal foot, but he believes that the tunnel took only 183½ bricks per lineal foot; the work at that time (1870) took himself and four bricklayers and nine laborers, for about 4½ months.

Mr. Higgins does not state: What this work cost him per 1,000 bricks laid; whether he made or lost money on the job, and how much; at what rate per day or per shift he charged up his own time; at what rate per day or per shift, or per 1,000 bricks laid by each bricklayer, he paid these four bricklayers; at what rate per day he paid the nine laborers, who helped the bricklayers; what number of hours constituted the length of a day's work or shift; what the board of the men cost him per head per working day, or per 1,000 bricks laid;

Complainant agreed to deliver at its own expense all materials to him at both ends of the tunnel, the west or inlet end starting from the bottom of the deep brick gate-shaft (f. in Table XXVI previously built by complainant)—and Mr. Higgins does not state whether the labor of lowering the materials from the surface down to the tunnel, and the cost of this extra labor, was included in his estimate as to labor employed; or, whether complainant furnished this labor at its own expense; or the number of hours per day which he worked his bricklayers and laborers on this contract job.

Mr. Higgins' answers, given from memory, relate entirely to the labor conditions existing in 1870, and are therefore not comparable with the same class of work, if done in 1903-04.

On account of the lack of data in Mr. Higgins' testimony, to which we have called attention, his testimony cannot be used to ascertain the original cost, nor does it furnish any evidence as to the present value of this structure.

2. Pilarcitos Tunnel No. 1.

(c. in Table XXVI of This Brief.)

What Is Shown by Mr. Higgins' Testimony as to His Contract Work on This Structure.

This tunnel was constructed in 1871; length of tunnel, 1,550 feet (Table XXIX; Complainant's Test. p. 770); number of bricks required, 341,000 (Table XIX).

Mr. Higgins' testimony as to this tunnel (page 6 et seq) shows in substance: This tunnel was bricked by Mr. Higgins, in 1871. He estimates that

its length is about 1,300 feet; but he is not positive about this, and thinks it may be longer. Complainant furnished all materials, such as sand, cement and brick; Mr. Higgins supplied tools, cars, candles and labor and boarded the men. He employed 4 masons and 11 laborers. He estimates 200 brick per lineal foot of a tunnel, which he thinks was 1,300 feet in length, but may be longer; he thus arrives at a total of 260,000 bricks. He thinks the work took about 42 days because he remembers having heard from "Mr. Abbey" that Lake Honda reservoir (in San Francisco) held forty-two days' supply, and he had agreed that if this Lake Honda supply ran out or became exhausted he (Mr. Higgins) was to stop working and allow complainant "to run sufficient through that tunnel to supply part of the city, without any extra expense to the company." The contract price, which Mr. Higgins received for this work, was $24 per 1,000 bricks laid.

From the above vague figures and computation, Mr. Higgins arrives at the conclusion that he must have averaged for each bricklayer about 1,500 brick a day of ten hours.

In order to arrive at this result of the number of 1,500 bricks laid per bricklayer per shift and day, in this narrow, cramped and wet tunnel, subject at any moment to the interruption of his work as above detailed, Mr. Higgins "estimates" about 200 bricks to the foot. He estimates the length of the tunnel at 1,300 feet (250 feet short of its actual length), though admitting that he is not positive about this length, as "it may be longer." As a matter of convenience, he takes Mr. Abbey's statement, that the Lake Honda reservoir (in San Francisco) held 42 days' supply, to mean that he, Mr. Higgins, probably finished the brick work in this tunnel in "about 42 days."

He then multiplies the assumed 200 bricks per lineal foot by the assumed 1,300 feet of length of the tunnel and this product of 260,000 he thinks gives him the number of bricks he laid in the tunnel under his contract in his assumed 42 days. From this he gets by computation 6,190 bricks laid daily by four men or 1,547 bricks per man which he rounds off to 1,500 bricks a day to each bricklayer in a 10-hour day.

Mr. Higgins says: The length of the day's work for bricklayers and helpers was 10 hours. The four bricklayers each received $5.50 a day of 10 hours, and their board, which he estimates at $5 a week, which would be 83 1-3 cents per working day. The eleven laborers (who in those early days did all the work of tending the bricklayers, including the work that is at the present time done by the hod-carriers and mortar-men) received $40 a month and board, which he figures (p. 9) at $2.25 per day, including board.

The daily wages paid by Mr. Higgins on this job to the bricklayers in 1871 was $5.50 and 83.3 cents for board per day's work of ten hours, would make $6.33 3-10 for 10 hours' work, or 63.33 cents per hour, and the laborers' day's work, including board, at $2.25 per day of ten hours, would be 22.50 cents per hour.

Mr. Higgins' recollections as to the daily performance of work, expressed in the number of bricks laid by the entire force of 4 bricklayers and 11 laborers, are based upon assumptions, which are, to say the least, very vague in their character, and it is impossible to determine from his testimony what was the actual cost per 1,000 bricks laid in 1871 of all the labor connected with this work of laying the brick in place.

Mr. Higgins' testimony regarding the number of bricks laid by each bricklayer in a day's work of ten hours, shows upon its face that it is erroneous. It is

based on a mere guess that he completed the work in 42 days and, on the erroneous assumption that the length of the tunnel was 1,300 feet, when it is actually 1,550 feet in length. Instead of 260,000 bricks, which Mr. Higgins computes for the entire tunnel, it requires 341,000 bricks for the actual length of 1,550 feet (Mr. Schussler's testimony, p. 770).

Mr. Higgins' four bricklayers together, in order to lay the 341,000 bricks in 42 days, would have had to lay, in round figures, 8,120 bricks in each day's work of 10 hours, or an average for each bricklayer of 2,030 bricks each.

The absolute impossibility of this daily performance per man, as well as the absurdity of this statement, is evident, and needs no further comment.

Regarding the price of $24 per 1,000 bricks laid in the Pilarcitos tunnel No. 1, which he states he received for the labor of laying the brick (while complainant, at its own expense, delivered to him all the materials, sand, cement and brick—at the respective ends of this tunnel) he states (p. 8) that he furnished "the tools, cars, candles and labor;" on page 9 he says that at this price of $24 per 1,000 brick, he made a profit, but he does not say what the profit was.

This price of $24 a thousand does not include the cost of the templets for the arches, as complainant furnished them to him.

As shown in our Table II the direct cost charges by complainant's accounting department to Pilarcitos tunnel No. 1 without any allowance for incidental, contingent, engineering and superintending expenses, are given as

Year ending June 1st, 1871.....	$16,489.84
Year ending June 1st, 1872.....	3,207.35
Total	$19,697.19"

Dividing this by 341, the number of thousands of brick laid in this tunnel, we get direct cost charges of $57.76 a thousand brick.

As we have shown previously, it is very doubtful whether this total of $19,697.19 includes all the charges that properly belong to the brickwork of this structure, showing conclusively that Mr. Higgins' random estimate (Test. p. 10) of $47.00 per 1,000 bricks laid complete in this tunnel, or $24.00 per 1,000 bricks for all labor, and $23.00 per 1,000 bricks for all materials, is altogether too low. It is $10.76 per 1,000 bricks below the direct cost charges made for this work by complainant's accounting department.

Mr. Schussler's estimate on this tunnel (Test. pp. 772-3) is as follows:

	Cost per day of 8 hours:
5 bricklayers (including board) at $6.80 per day of 8 hours	$34.00
3 hod-carriers and mortar men (including board) at $4.30 per day of 8 hours	12.90
5 laborers (including board) at $2.50 per day of 8 hours	12.50
1 carpenter (including board) at $4.00 per day of 8 hours	4.00
Total: 14 men, costing per day of 8 hours	$63.40

This $63.40 represents the cost in 1903-04 of all labor required for laying in this tunnel 2,000 bricks, or $31.70 per thousand (see detailed statement, sub. c, Table XXIII).

By adding to this cost of labor per 1,000 bricks laid the cost of all materials delivered at this tunnel, of $31.58 per 1,000 bricks laid (Tables XVIII and XXIV,

sub. c), we have the total cost per 1,000 bricks laid in this tunnel (1903-04) of $63.28, which is rounded off to $63.00 per 1,000 bricks laid, inclusive of all labor and materials. (See Table XXIV, sub. c.)

Comparison of this with the accounting department direct cost charges in 1871 of $57.76 shows that Mr. Schussler's estimates were very conservative.

3. Lock's Creek Tunnel No. 1.

(c, in Table XXVI of this brief.)

What Is Shown by Mr. Higgins' Testimony as to the Contract Work on This Structure.

This tunnel was constructed in 1871-2 by contract. Length of tunnel, 3,200 feet; number of bricks required, 704,000 (Table XIX and Complainant's Test., pp. 1017-18).

Mr. Higgins' testimony as to this tunnel is in substance as follows (Defendants' Test., pp. 12 and 13):

Mr. Higgins' took this contract for $16.00 per 1,000 bricks, for all labor required in laying the brick, he also supplying tools; while complainant furnished all materials: brick, sand and cement. Work to be completed in sixty days (probably means working days), and, if not completed in this time, contractor to forfeit $100 for every day over that time.

He thinks he completed about 3,100 feet of that tunnel within the sixty days. Was stopped by storm. Later on he went back and finished the tunnel alone.

He employed 8 bricklayers and 16 laborers. The bricklayers received $6.00 per day and board, which he figures at $1.00 per day (which makes $7.00 per working day of bricklayers). The laborers received $40 per month and board, making a total of $70 per month (which makes $2.69 per day's work of laborer). In re-

gard to the number of bricks required per lineal foot, Mr. Higgins says:

"We laid 200 brick to the foot, and each mason would average about 1,300 per day."

Q. 41: "Mr. Schussler, in his direct testimony, page 1018, testified as follows: 'The bricking up of this tunnel required an average of 220 brick per lineal foot.' Is that the fact?"

A. "I would not like to say whether that was the fact or not. It was a tunnel about the same as the others; they called for 205 and 210. I would not say about 220. I would not like to dispute that, or to say which way it was. As near as my recollection serves me I was paid for 200 brick to the foot."

Q. 42: "Per lineal foot?"

A. "Yes. That is as near as my recollection serves me" (p. 13).

* * *

Q. 46: "How many bricks do you estimate were laid in Lock's Creek tunnel No. 1?"

A. "We laid 200 brick to the foot, making, for the 3,200 foot tunnel, 640,000 brick laid, at that time. There were more in the tunnel, and I went back in the fall and finished it" (pp. 14-15).

These quotations clearly show that Mr. Higgins, in his testimony regarding this piece of brickwork (which was constructed about a third of a century ago) relies entirely upon his memory and "recollections." It is therefore excusable if he thinks, after this long lapse of time, that he averaged the incredible daily task per bricklayer of 1,300 bricks a day—as in this long, small and cramped tunnel the work has to be done at great disadvantage, causing unavoidable delay and loss of time.

That the $100-per-day forfeit, which he says he was to pay if he exceeded the 60-day limit, in which, according to his recollection, the bricking of the entire 3,200

feet of tunnel was to be finished, was in all probability not enforced by complainant—is shown by his statement that he went back "in the fall" (probably of 1872) and finished the work in the tunnel.

Furthermore, if Mr. Higgins had known or expected that this forfeiture clause of $100 penalty for every day exceeding sixty days would be rigidly enforced, it is probable that, instead of working only two shifts of bricklayers and laborers at each end of the tunnel per 24 hours (which he indicates by employing only 8 bricklayers and 16 laborers), he would have worked his bricklayers and laborers in three eight-hour shifts (employing not less than 12 bricklayers and 24 laborers), in order to hurry the work so as to finish it in as short a time as practicable. It is, therefore, most probable that if his recollection serves him right, in that he employed only eight bricklayers and sixteen laborers per day, he spent on this work a much longer time than the sixty days in which he assumes he completed 3,100 out of the 3,200 feet of the tunnel.

Yet this sixty-day limit is used by Mr. Higgins (as he used an assumed 42-day limit for Pilarcitos tunnel No. 1) as the basis upon which he figures the number of bricks that each bricklayer might have laid per day in this long narrow tunnel.

Although, according to his testimony, he finished only about 3,100 feet of the tunnel in the 60 days, he arrives at his estimate of the number of bricks laid in a day by multiplying the whole length of 3,200 feet of tunnel by 200, which he thinks is about the number of bricks to a foot. In this way he arrives at a total number of bricks in the entire tunnel of 640,000. By multiplying 8 bricklayers by 60 days he gets 480 bricklayers' day's work, and by dividing 640,000 bricks by 480 days' work he obtains 1,333 bricks per bricklayer per day, which

he rounds off to 1,300 bricks laid per day to a man. This excessively high figure he gives as a bricklayer's day's work in this long, small and cramped tunnel.

Mr. Schussler gives detailed estimates showing a total cost for labor of $31.70 per thousand, and the average number of bricks per man for 8 hours 400 (Table XXIII), and in Table XVIII it is shown that the materials (sand, cement and bricks) delivered at this tunnel, which is difficult of access, would cost in 1903-04 $34.51 for every 1,000 bricks laid, which, as shown in Table XXVI, makes the total cost per 1,000 bricks laid in this tunnel, under present conditions, in round figures, $66.00 per 1,000.

Mr. Higgins, on page 14 of his testimony, regarding these materials estimates the cost, provided "his recollection serves him right," as:

Sand and cement, including hauling	$10.00
Cost of brick, including hauling and handling	17.00
Total	$27.00 per

1,000 bricks laid—being Mr. Higgins' idea of total cost of materials delivered.

To this he adds (assuming, from recollection, that he finished the brickwork for 3,100 feet of this tunnel in 60 days) for labor $16.00 per 1,000 bricks laid.

He thus arrives at the astounding result that this brickwork, complete, at the time of its construction, a third of a century ago, cost $43.00 per 1,000 bricks laid.

As shown above, sub. Pilarcitos tunnel No. 1 (the cost of which Mr. Higgins assumes to have been $47.00 per 1,000 bricks laid), the cost charges to that tunnel, made by complainant's accounting department, make the direct cost of each 1,000 bricks laid in that Pilarcitos tunnel No. 1 $57.76.

This latter tunnel is about of the same small and cramped size as Lock's Creek tunnel No. 1; but, while Pilarcitos tunnel No. 1 is 1,550 feet in length, the Lock's Creek tunnel No. 1 has a length of 3,200, or fully twice the length of the former.

Mr. Higgins, according to his testimony, had bricked the Pilarcitos tunnel No. 1 in 1871, which tunnel has a length of 1,550 feet, and (without a penalty or forfeiture clause hanging over him) he did this work by contract, as he claims, for $24 a thousand bricks laid.

In the same year (1871), according to his recollection, he took a contract for laying the brickwork in the Lock's Creek tunnel No. 1, which was more difficult of access and 3,200 feet long (or fully twice the length of the former), for only $16.00 for laying 1,000 brick. In addition to this, he claims the contract contained a clause that he should forfeit $100 for each day by which he exceeded the limit of sixty days allotted to him for the completion of the entire tunnel. His subsequent statement that he went back in the fall (probably of 1872) and finished the tunnel, shows that the forfeiture clause, if it existed, was not taken seriously.

But, the mentioning of this supposed sixty-day time limit gives Mr. Higgins a time basis, which, divided into what he thinks he recollects was the total number of bricks required for the entire tunnel gives him, as he wishes to show it, the daily performance as to the impossible number of bricks laid, by his eight bricklayers jointly, or by each bricklayer separately.

Further comment is unnecessary.

3a. Small Brick Cap on Pilarcitos Stone Dam.

What Mr. Higgins' Testimony Shows as to His Work on This Dam.

(d in Table XXVI and Complainant's Testimony, p. 1012):

Although this piece of brickwork was done by day's work, and not by contract work, it is inserted at this point as, according to Mr. Higgins' testimony (page 12) it was constructed at the same time that the construction (by contract work) of the above Lock's Creek Tunnel No. 1 was in progress. As Mr. Higgins, in this testimony, says that he sent one of his masons over from the tunnel to do this piece of brickwork, it is of interest here to see what daily performance in regard to the number of bricks per day laid in this structure may be attributed to the one mason, who he says he sent to do this work.

Referring to the small brick cap, constructed on the top of the Pilarcitos stone dam, Mr. Higgins says (p. 12):

> Q. 39: "Do you know how many brick were laid on that dam?"
>
> A. "I do not. I sent a mason over from Lock's Creek tunnel, where I was working on a contract job, and he alone finished the job in about four days. I did not pay any attention to it."

Mr. Schussler shows that this piece of brickwork contains "10,700" bricks (Complainant's Test., p. 1012).

By dividing this number of bricks by Mr. Higgins' four days' work of one bricklayer, it would appear that the bricklayer, who, according to Mr. Higgins, completed this brickwork in about four days, laid 2,675 bricks a day.

Although Mr. Higgins qualifies his statement somewhat, by saying that he did not pay any attention to it, still, the fact remains that he does state that the one bricklayer, whom he sent "alone, finished the job in about four days."

The fourth and last hydraulic brick structure that complainant let out by contract was built by Mr. Higgins, as contractor. This was:

3b. Stone Dam in Pilarcitos Valley.

What Mr. Higgins' Testimony Shows as to the Work on This Dam.

The "small brick cap" spoken of in the preceding subdivision was placed on the top of what is known as "Pilarcitos Stone Dam."

Although this stone masonry dam does not belong to the class "Brickwork," still, as Mr. Higgins in his testimony on brickwork refers to this stone dam, an analysis of his testimony on this subject is here inserted.

On this subject he says (pp. 10-12):

Q. 34: "Will you describe in detail the work you did on Pilarcitos stone dam?"

A. "I was employed as foreman of that dam and had charge of the masons and laborers. The dam was constructed in 1871 and was built by the day, that is, the contract was let for the work. The rock for the dam was got about 200 or 300 feet away, on the upstream side out of a granite canyon. There were lots of loose rock, and they did not have to blast. I do not remember a bit of powder being used. The cement was hauled from Millbrae. The sand was gathered from the creek beds in the neighborhood. A 6-mule team would haul in a load of cement 16 to 20 barrels to the load. That was a day's trip for the

team, and would do us for two or three days. Then the team would haul up rock enough for one or two days. That one team kept us going, hauling the rock the sand and cement. There were two masons and myself and three laboring men engaged in the work. At one time I had three masons besides myself, but one mason left. Each mason, including myself as one, laid from 1½ cubic yards to 2 cubic yards of masonry per day. The three of us working together averaged about 5 yards per day, working 10 hours. I received $7 and board, the other masons received $4 and board. The laborers were paid $30 per month and board. We used about ¾ of a barrel of cement to 1½ barrels of sand."

Q. 35: "What do you estimate it cost a yard to construct the Pilarcitos stone dam?"

A. "Not to exceed $10. That estimate is based on the following details:

One man, $7 a day; with board at 75 cents per day, makes a total of	$ 7.75
2 men, including board	9.50
3 laboring men, at $1.90 a day, including board	5.70
Total pay for labor per day	$22.95
These men lay 5 yards of masonry a day, making the cost of labor per yard about	$ 4.55

Allowing an entire barrel of cement for each yard laid, I place the cost of cement including hauling at $3. Cost of rock and sand, including hauling and quarrying, $1.50.

That would make the cost complete $9.

I have allowed one dollar extra in my estimate.

Q. 36: "Would you do that work for $10 a cubic yard today?"

A. "I would."

Mr. Long: Q. 37. "And in making that statement you take into consideration the changed conditions, the increased cost of labor and materials, do you?"

A. "Yes, I figured that out; that would be about 75 cents a yard difference."

Q. 38: "You have taken into condition" (consideration) "all the changes in conditions between that date and the present time?"

A. "Yes sir. I would do it for $10 today."

As to the manner and locality in which the stone was obtained, which was required and used in the construction of this dam, which took 16,145 cubic feet of stone masonry for the dam and 715 cubic feet of stone masonry for the piers, for which latter, the stones were trimmed and the corners cut (Complainant's Test. p. 1012), Mr. Higgins, evidently speaking from recollection, assumes that all of this building stone was found

> "about 200 or 300 feet away, on the upstream side out of a granite canyon. There were lots of loose rock, and they did not have to blast." (p. 10.)

The judge of this court having in accordance with the stipulations of the parties visited and inspected these works, will no doubt have noticed that there is no granite canyon 200 or 300 feet upstream from the dam, nor could any such canyon, if it existed, be relied upon for obtaining the required stone without blasting. The court probably also noticed, on inspection of the territory, that a quarry about thirty feet wide and about forty feet deep was opened into the granite slope of the canyon about a quarter of a mile down stream from the Pilarcitos stone dam, from which this stone was obtained, and that evidences of blasting and stone-cutting are apparent on stones that have been quarried there and that still remain.

Although on page 10 of his testimony, Mr. Higgins says: "There were lots of loose rock and they did not have to blast," he in effect contradicts this on page 11

by saying: "Cost of rock and sand, including hauling and quarrying, $1.50."

In regard to the sand, he evidently assumes that the same caused no further expense than the hauling, as he makes no allowance for cost of labor for gathering, screening and drying the sand and loading it on to the wagon.

The cement used in this dam he "places" at $3 a barrel, "including the hauling," by which he probably means the railroad transportation from San Francisco to Millbrae station and thereafter the hauling by team over the steep mountain roads from Millbrae station to this dam.

The record does not show what the cost of hydraulic cement was per barrel at that early period (1871), but it is evident, as has been shown in the analysis in this brief, of the item of hauling, that 16 barrels forms the maximum load that a 6-mule team could haul to this place from Millbrae, making one round trip a day.

As at that time, according to defendants' witness, Mr. Fifield, he was paid $10 a day for a 4-mule team (which included maintenance of team and pay and board of driver), it is likely that a six-mule team, at this ratio, would have commanded at least $12 a day. This would make the cost of hauling 16 barrels of cement to the load, from Millbrae station to the site of the Pilarcitos stone dam, at the rate of 75 cents a barrel.

Or, if the cement had been hauled by Mr. Fifield's four-mule team, at $10 a day, hauling even 12 barrels to the load, the hauling of a barrel of cement would have cost 83 1-3 cents.

Making allowance for cost of handling the cement in San Francisco on to the railroad cars, and for rail-

road transportation to Millbrae at only 10 cents per barrel (see page 852 of Mr. Schussler's testimony), we have the cost of transportation of a barrel of cement at that time, from San Francisco to the Pilarcitos stone dam, at 10 cents for railroad transportation, and 75 cents for hauling, or a total of 85 cents per barrel of cement, delivered from San Francisco to the stone dam.

As Mr. Higgins' estimate of cost for 1871 is only $3 per barrel of cement delivered at the dam-site, there would remain for the cost of a barrel of hydraulic cement in San Francisco only $3 less 85 cents, or $2.15 per barrel.

Although the cost per barrel of hydraulic cement in San Francisco, in 1871, is not of record, it is a well-known fact that in those days the cost of cement was higher than at present.

Mr. Schussler, in his estimate of cost of reconstructing the Pilarcitos waste-weir (which is located in what has heretofore been called the Pilarcitos region), quotes the cost per barrel of hydraulic cement, delivered at Millbrae railroad station, at $2.75. (Test. p 753.)

Deducting from this figure the cost of railroad freight from San Francisco to Millbrae of 10 cents a barrel (Complainant's Test. p. 852), we have the present cost in San Francisco of a barrel of hydraulic cement at $2.75, less 10 cents, or $2.65 a barrel.

Although, as above mentioned, there is no doubt that about a third of a century ago, when the Pilarcitos stone dam was built, the cost in San Francisco of a barrel of hydraulic cement was higher than at present, still, even if we adopt the present low figure of only $2.65 per barrel in San Francisco, as the cost then, and add to this sum the cost at that time of trans-

porting and hauling a barrel of cement from San Francisco to the site of the Pilarcitos stone dam, of 85 cents, we would have instead of Mr. Higgins' allowance of $3 per barrel $2.65, plus 85 cents, or $3.50 per barrel, which represents an addition to Mr. Higgins' allowance of $3 per barrel of at least 16 2-3 per cent in the cost of cement delivered.

Assuming that, as Mr. Higgins thinks, the three masons (himself included) laid in cement mortar an average of about 5 cubic yards of this stone masonry in a day of ten hours, it would follow that in a working day of eight hours, these three men together would have laid about 4 cubic yards in a day, or, in other words, at this average ratio of hourly performance per stone mason, these three masons in an eight-hour day would each lay 1.33 cubic yards a day.

In order to ascertain what three stone masons, working eight hours a day and being assisted by the proper number of hod-carriers, mortar-men and laborers, as required by them during the present times of organized labor, we will assume that about the same proportion of assistance is given to the stone masons, as is given to bricklayers. Instead of the three stone masons employed, who, according to Mr. Higgins' testimony, required three laborers to assist them, or one laborer to each stone mason, there would have then been required five laborers, if five stone-masons had been employed instead of three. Under the present conditions of organized labor, two of these five laborers would probably now be mortar-men or hod-carriers, while the remaining three helpers would be common laborers.

Assuming that each of these five stone-masons, while working eight hours a day, would now execute the same

daily performance as Mr. Higgins' men, or 1.33 cubic yards (per day of eight hours), the five masons would accomplish 1.33 x 5 or 6 2-3 cubic yards of masonry in a day of eight hours.

The cost of labor per day, while doing this amount of work, at the present time, and at the schedule of wages and board equal to that of brick-masons, hod-carriers and laborers (see pages 927-8 of Mr. Schussler's testimony) would be as follows:

5 stone masons, including cutting and trimming, at $6.80 a day (including board)	$34.00
2 hod-carriers and mortar-men at $4.30 (including board)	8.60
3 laborers at $2.50 (including board)	7.50
	$50.10

The cost of labor, therefore, if this work of laying 6 2-3 cubic yards of this masonry now (in 1903-4), would be $50.10÷6.66 cubic yards, or $7.50 per cubic yard of masonry.

To this amount there should be added the present cost of cement and sand, delivered at the dam-site, at the rate of one barrel of cement and two barrels of sand per cubic yard of masonry.

Although the distance hauled from Millbrae is greater than that to the Pilarcitos waste-weir (Complainant's Test. pp. 752-3-4), we will assume the same cost delivered as there given (for 1903-4) of $3.37½ per barrel of cement, and 76 cents per barrel of sand.

There being two barrels of sand required to each barrel of cement used, the two barrels of sand used per cubic yard of masonry would cost, delivered at the damsite, 76 cents times two, or $1.52.

Thus the cost of cement and sand required per cubic

yard of this stone masonry would, at the present time, be: Cement $3.37½, sand $1.52; total $4.89½.

There are no separate data furnished in the testimony regarding the cost per cubic yard of quarrying the stone, trimming and cutting a portion of the same and hauling it from the quarry to the dam site. The only figure given on this subject is found on page 11 of Mr. Higgins' testimony, which is not only vague, but also low, and which reads: "Cost of rock and sand, including hauling and quarrying, $1.50."

The only figure given by Mr. Schussler is that regarding the cost of rock excavation for the foundation of the dam, which is given on page 1012 of his testimony as follows: "Pilarcitos stone dam: Rock excavation, about 190 cubic yards at $1.50 a cubic yard."

Assuming, in the absence of any other cost figures, that the building stone required for the masonry of the dam, could have been quarried, partly trimmed and cut, and hauled from the quarry to the dam for this same very low figure of $1.50 per cubic yard, the following would be the cost per cubic yard of this stone masonry, if done at the present time and under the conditions as they now exist: Labor of stone masons and helpers, $7.50; cement and sand, $4.89; stone, $1.50. Total, $13.89 per cubic yard of stone masonry in the entire dam, and including the extra work of trimming and cutting the corner stones for the piers.

Mr. Schussler's testimony regarding the cost of reconstruction in 1903-4, of the stone masonry in this dam, is as follows (p. 1012):

"16,145 cubic feet of stone masonry at 50 cents a cubic foot..... $8,072.00"
(or $13.50 per cubic yard.)

"This includes the quarrying of the stone, the hauling it up from the quarry, the cement, with its

transportation, the sand, the stone masons' wages and board, mortar-men and so on. 715 cubic feet of stone piers—trimmed and the corners cut—at 75 cents a cubic foot, set complete, with all those other items, such as cement, labor, wages, board, sand and everything thrown in, $536."

This shows that the cubical contents of stone masonry in this dam is: 16,145 cubic feet of plain masonry, 715 cubic feet of masonry trimmed or cut, making a total of 16,860 cubic feet, or 624.4 cubic yards of stone masonry.

Mr. Schussler's cost estimate for 1903-4, exclusive of incidental, contingent, engineering and superintending expenses, is, as above shown, $8,072 and $536, or a total of $8,608.

This sum, divided by the total number of cubic yards of stone masonry, gives $8,608 divided by 624.4 cubic yards, or $13.78 per cubic yard.

The following comparative table (Table XXVII), which, on the one hand, gives the length of the day's work of ten hours and the low wage schedule ruling in 1871, as given by Mr. Higgins as the basis of his estimate of cost per cubic yard in that year; and, on the other hand, the length of the day's work of eight hours, and the wage schedule ruling in 1903-4, as used by Mr. Schussler as a basis of his estimate of cost of reproduction per cubic yard in the latter year, shows the respective percentages of increase between 1871 and 1903-4, in the cost of this class of labor performed per hour:

TABLE XXVII

	MR. HIGGINS' ESTIMATE FOR 1871 *Length of day's work*, 10 *hours*		MR. SCHUSSLER'S ESTIMATE FOR 1903–4 *Length of day's work*, 8 *hours*	
		Cost per hour		Cost per hour
MASONS	1 mason (Higgins) days wages $7.00 days board .75 Total per day $7.75 or	77.5 cents per hour		
	2 masons days wages of each $4.00 day's board .75 Total per day $4.75 or	47.50 cents per hour each		
	Average cost of each of 3 masons per day $5.75 or	57.5 cents per hour	Each of 5 masons day's wages $6.00 day's board .80 Total per day $6.80 or	85 cents per hour each
HELPERS			2 hodcarriers and mortar-men day's wages of each $3.50 day's board .80 Total per day $4.30 or	53.75 cents per hour each
			3 laborers day's wages of each, including board $2.50 or	31.25 cents per hour each
	3 laborers day's wages of each including board $1.90 or	19 cents per hour each	Average cost per man of 2 mortar-men and 3 laborers per day $3.22 or	40.25 cents per hour average each

As shown in the foregoing Table XXVII, the average cost per hour of the work of masons in the above

structure has increased from 57.5 cents per hour in 1871 to 85 cents per hour in 1903-4; showing an increase during the intervening period of nearly one-third of a century, of 47.8 per cent; while the cost of labor per hour, used to assist the masons in their work, which, according to Mr. Higgins, in the early days was done by common laborers, but is now (in 1903-4) done partly by mortar-men and hod-carriers and partly by laborers, but at a much greater cost per hour than formerly, has, during the same long period of time increased from 19 cents per hour in 1871 to an average of 40.25 cents per hour in 1903-4. This shows an increase of 111 per cent.

As shown in the quotation from page 11 of Mr. Higgins' testimony, he there estimated that the above stone masonry in the Pilarcitos stone dam cost in 1871, only $10 per cubic yard in place, including all stone quarried, prepared and delivered at the dam, as well as all cement and sand, and also including all wages and board of masons and laborers, yet, in the face of the great increase since then in the cost of labor he still says he would do that work for $10 a cubic yard today.

3c. Concrete Lining of University Mound Reservoir.

What Mr. Higgins' Testimony Shows as to the Work on This Reservoir.

Although this work does not belong to the class, "brick work," still, as Mr. Higgins, in his testimony (pp. 2, 25-6-7), refers to it as having worked there, an analysis of his testimony is here inserted. He says:

> "In 1885 I was engaged in lining the University Mound reservoir with concrete." (p. 2.)

"I was employed by the day on that work. The concrete in this reservoir was laid 4 inches thick." (p. 25.)

"Imported Portland cement was used in this work. Two barrels of sand, that is about 6 cubic feet of sand were used to one barrel of cement. The men employed in this work worked 10 hours a day and boarded themselves."

Q. "What is your estimate per superficial foot inclusive of everything, for laying concrete in the University Mound Reservoir."

A. "I have taken this work at say one day's wages for all the men that were working in there; that is the only way I could get it. All the wages, including everything there, amounted to $105 a day; we averaged 75 barrels of cement a day, equal to 55½ cubic yards, at a cost of $1.90 per cubic yard, or 2 1-3 cents per superficial foot; that is for labor. How I get at the average of that is that in the bottom we averaged say, 95 barrels per day, in the sides, 65, making 160 barrels; taking half of that would be 80, and I have put it down at 75 barrels per day, which gives me 55 yards. We therefore have the following amounts:

Labor	$105
55½ yards of rock, at $1.50, which was a good price for delivering it	83
75 barrels of cement and sand at say $4 a barrel, which is ample	300
making a total for one day's work	$488

which we will call 11 cents per superficial foot complete.

There were 58½ yards, and, 27 feet to the yard, gives you a total of 1,498 feet; multiplying that by 3, it gives 4,494 feet, which at 11 cents per foot, will make a total of $494." (pp. 26-27.)

Mr. Higgins' testimony indicates that, in the absence of definite and accurate memoranda made at the time of the construction of this work, in 1885, twenty years

prior to giving his testimony, he evidently had to resort to a species of computation based upon what he considered to be his recollection of what was "about" a day's performance and "about" the quantity of materials used in a day and of the unit cost of materials delivered.

The hard fine crushed rock used in this very particular piece of concrete work, he assumes could be delivered at the reservoir at $1.50 per cubic yard. His testimony is: "55½ yards of rock at $1.50, which was a good price for delivering it—83."

He evidently does not remember that this rock had to be quarried at a distant quarry; that it had to be crushed into small fragments owing to the comparatively thin bed of concrete required; that it had to be loaded on to wagons and hauled to the site of the reservoir and there delivered.

And all of this work, with perhaps a rental for the use of the quarry added thereto, Mr. Higgins' guesses could be done for the low figure of $1.50 per cubic yard of first-class and finely crushed rock delivered at the reservoir.

By way of comparison, Mr. Schussler's testimony relating to the cost of crushed rock delivered at the concrete foundation of the Presidio Heights tank in San Francisco (p. 1431), gives the cost per cubic yard of this crushed rock delivered at $2,349 for 1,025 cubic yards of rock; or $2.29 per cubic yard so delivered. And this rock, being No. 2 and No. 3, was not crushed as fine as that used at the University Mound Reservoir and was therefore less expensive than the latter.

For cement and sand delivered, Mr. Higgins gives no separate estimate, but lumps the two together.

He states that the day's work was ten hours, but he

does not state what the day's wages were for the laborers employed in mixing, handling, spreading and ramming the concrete in place on the bottom and slopes of the reservoir.

He does not say what wages or salary he received for himself, nor whether he has added this item of cost to his estimate of cost of labor per day. He lumps the wages as "all the wages, including everything there" at $105 a day.

In the absence of details as to labor, as well as of reliable data regarding the cost at that time, in 1885, of the materials delivered, it is impossible to determine from Mr. Higgins' testimony what the cost per cubic yard of concrete actually was at that time, nor what it would be at the present time.

Mr. Schussler estimates the concrete which it would take to line the University Mound Reservoir, 150,000 cubic feet, and the cost at $54,000 (pp. 1371-2). This figure, for this concrete, carefully spread and rammed over the bottom and slopes of this reservoir, makes the present cost per cubic foot of this concrete in place 36 cents per cubic foot.

Mr. Schussler estimates the concrete around the forebay tunnel (complainant's exhibit 72) as 7,580 cubic feet, and the cost of reproduction $2,730, which is also 36 cents per cubic foot of concrete.

First-class concrete was also used in other works of complainant within the City and County of San Francisco, as, for instance, in the foundation of the Presidio Heights tank, where it was placed in one large compact mass, and in a comparatively small area; while in the concrete lining of the above-quoted University Mound Reservoir, the concrete was spread and rammed

in a comparatively light layer over the large area of 360,000 square feet (Complainant's Test. p. 1371).

At the Presidio Heights tank foundation, which was constructed of late, and during the prevalence of the present scale of wages per hour and cost of materials (Test. p. 1431), the rock crushed and delivered, the cement, sand and lumber delivered, and the labor employed in the concrete work, amount to $7,834 for 833 cubic yards, or 22,491 cubic feet. This makes the cost per cubic foot, $7,834 divided by 22,491 cubic feet, or 34.83 cents per cubic foot, in comparison with which his estimate of 36 cents for the more expensive work on the University Mound Reservoir is low.

By dividing the 150,000 cubic feet of concrete by the area of 360,000 square feet in the plan of the reservoir, we obtain an average vertical depth of the concrete lining of 150,000 cubic feet divided by 360,000 square feet or 0.416 feet. The average square foot covered, therefore, at the cost of 36 cents per cubic foot, would be 0.416 times 36 cents, or 14.97 cents, or in round figures 15 cents per square foot, which rounded off figure is used on page 1371 of Mr. Schussler's testimony.

4. The Six-Mile House Tunnel.

What Mr. Higgins' Testimony Shows as to the Brick-work on This Tunnel.

(k., in Table XXVI.)

This brick work was constructed in 1883-4 by contract: Length of tunnel, 2,145 feet; number of bricks required, 430,000 (Table XIX); (Complainant's Test. pp. 997-1002).

The contract for the drifting, timbering and bricking of this tunnel, according to defendants' testimony (p. 17) was dated October 9, 1883, and required the

contractor, under penalties, to complete the drifting and timbering of the tunnel at the rate of not less than 270 lineal feet per month thereafter, and within sixty days after such completion of the tunnel, to complete the brickwork in the tunnel according to complainant's plans and specifications, and to complete the entire drifting and bricking within ten (10) months from the date of the contract.

That, as in another contract previously examined, Mr. Higgins did not fear the enforcement by complainant of the penalty clause for exceeding the time limit, is shown on page 17 of Mr. Higgins' testimony, where he says the drifting "was finished October 7, 1884." As the tunnel was 2,145 feet long and he was required to drift at the rate of not less than 270 feet a month, he was required to finish the drifting in a little less than 8 months, or say by June 7, 1884, and to finish the whole tunnel within 60 days thereafter. He says after finishing the drifting he commenced the brickwork. In other words, he shows that he only commenced the brick work two months after the whole job of drifting and bricking was to be finished.

He does not say when he finished the bricking; nor how many bricklayers, helpers or laborers he employed to the shift; nor (if this was a hurry job) how many shifts of bricklayers, helpers and laborers he employed in each 24 hours; nor whether he worked the men in three eight-hour shifts, or in two ten-hour shifts per day; nor does he give the wages which he paid the men that did this work; nor whether he boarded the men, and, if so, at what cost per day.

He does not state in his testimony (according to which he had taken this contract for this brick work at the extremely low figure of $6 per lineal foot of

tunnel, or $30 per 1,000 bricks laid, inclusive of all materials) whether he made a profit or lost money on this job.

He does not state how the final financial settlement with complainant was made, and what final total figure represents the entire cost to complainant, both for the drifting and the bricking of this tunnel.

Mr. Higgins' testimony would indicate that he not only laid the brick, but also furnished the brick for the tunnel at this price of $6 per lineal foot. According to the contract (Defendants' Test. p. 18) after the entire tunnel is fully completed and timbered the contractor:

> "will then commence and finish* the brick work of said tunnel according to the plans, specifications and diagrams aforesaid within sixty days after the completion of the excavations therefor. And complete the whole within ten months from the date of this contract."

*(Note—This word is typewritten in the testimony as "furnish," but this is an error in copying, as in the original exhibit on file (Defts. Ex. 58) the word used is "finish.")

The fact that the brick was not furnished by Mr. Higgins but by the complainant, and that Mr. Higgins, under this contract, only did the work of laying the brick, is confirmed by his own testimony as to how the brick was delivered to him. He says (Defts'. Test. p. 23):

> "The brick were delivered to me at Lake Merced Coal Yard costing $10 per thousand; the hauling cost $2.50 per thousand."

The Lake Merced Coal Yard there referred to was one of the properties of the complainant. Measured by scale on the diagram of complainant's properties it appears to be about six miles from the Six-Mile House tunnel, where Mr. Higgins was working. Something like that distance, in any event, is indicated by the cost of hauling, which he says was $2.50 per thousand. Certainly, if the bricks were furnished by Mr. Higgins there is no reason why he would have had them delivered to him on another property of the complainant where he was not working instead of at the site where he was performing his contract.

It will be noticed that Mr. Higgins himself does not say who delivered the brick to him, whether it was complainant or a brick manufacturer. Nor does he state whether the hauling cost $2.50 per thousand to him or to complainant, or whether he simply now estimates the former cost of these two items.

Furthermore, he does not mention the cost of either cement or sand, nor does he say in his testimony whether he actually paid for the cement and sand used in this tunnel and for the hauling of the same; or whether complainant actually paid for them and furnished them at the tunnel.

As the running foot of the brick work in the tunnel requires 200 bricks, he would, at the price of six dollars per lineal foot, of the brick work, receive for all materials and all labor of bricking combined only $30 per thousand bricks laid.

As above shown, he mentions, on page 23 of his testimony, his estimate of the cost of brick delivered at the tunnel at $12.50 per thousand. On page 24 he estimates for two other tunnels on the same Crystal Springs line, but nearer San Francisco, and thus re-

quiring a shorter haul, for brick delivered, $12.50 per 1,000; cement and sand delivered, $9 per thousand bricks laid.

The total of these items, therefore, of his cost estimates for 1884, of brick, cement and sand delivered at the tunnel, amount to $21.50 per 1,000 bricks laid.

He says according to his contract he received only $30 per 1,000 bricks laid, which total included, besides the above $21.50 worth of material, the cost of all the labor, such as bricklayers' wages, helpers, laborers, board, as well as cars, tools, candles, and, last, but not least, a fair compensation for Mr. Higgins as contractor, who not only had to give his time to this work, but also (according to the letter of the contract) had to assume all the risk and loss.

And all of these items, comprised in this long list under the head of labor, he wishes to have understood was included in and paid for by the price of $30, less $21.50, or $8.50 per 1,000 bricks laid in this tunnel.

On page 23 Mr. Higgins says that: "Each man laid about 10 feet of brickwork with 200 brick to the foot, averaging about 2,000 a day."

Compared with the highest estimate made by himself or any other witness of the number of brick laid per man per day in any of the structures this estimate of 2,000 bricks a day, especially in this long narrow and cramped tunnel, is so wildly extravagant as to stamp it as impossible, and to throw discredit on all the rest of Mr. Higgins' testimony.

Possibly the time-limit of sixty days, given in the contract, for the completion of the entire brick work of 430,000 bricks to be laid in this tunnel, was in his mind when he arrived at the incredible figure of 2,000 bricks per day laid by each mason, although he does

not say how long he was engaged in laying bricks after starting that part of the work.

Mr. Higgins' Testimony as to Day Work.

Mr. Higgins says he was employed as foreman of bricklayers in looking after the hydraulic brickwork of the following three prominent structures erected by day's work by complainant during the period from 1874-5 to 1887:

5. San Andres waste-weir (h., Table XXVI);
6. Bernal Tunnels (m., Table XXVI);
7. Crystal Springs shaft and tunnels at main dam (i., Table XXVI):

Besides these three larger hydraulic brick work structures, Mr. Higgins states that he looked after a small brick work structure: the Forebay and Outlet Tunnel of the College Hill Reservoir in San Francisco, in the year 1870. We will examine this Forebay and Outlet Tunnel first and then discuss the three other structures in the order above given.

The Brick Forebay and Tunnel.

What is Shown by Mr. Higgins' Testimony as to the Day Work on This Structure.

Mr. Higgins gives no details as to the cost or number of brick, cement and sand required for this small structure, nor the number of days' work of brick masons and helpers used in its construction, but he simply states from what he thinks he remembers was the average day's work done by each brick mason, as follows (Test. pp. 5-6):

> "I was told to hire the men by the day and the company would furnish everything. The men were

paid $5 per day for eight hours' work, without board. We averaged about 1,200 brick to the man. In that work the cement used was Rosedale cement."

Mr. Kellogg. Q. 23. "How many brick did you say to the man?"

A. "About 1,200. I do not say that is positive, but about that."

This testimony of Mr. Higgins again shows that in the 35 years that have elapsed since this small structure was built, he is positive only as to the fact that he looked after the work, but he is in doubt as to the number of bricks laid per man per day.

Although in the long, narrow and cramped Six-mile House tunnel he claims that the bricklayers averaged 2,000 bricks a day to a man, he thinks that in the shorter and more accessible structure, at the College Hill Reservoir (a part of which was work in the open), the average was 1,200 bricks a day, but he is not positive about this.

Mr. Schussler figures this cost of reconstructing this small structure in 1903-04, as follows: "Brick forebay No. 1 and tunnel, 60,000 brick, hauling, cement, sand, labor, help, etc., at $43 per thousand, $2,580."

This forebay and tunnel work (being largely arch work) done under more favorable conditions than that in the long, narrow and cramped tunnels, would, as regards daily performance per brick mason, approximately belong to Group C, in Table XXIII and Table XXIV, in which group the present performance of a bricklayer is averaged at about 500 bricks per day of eight hours, or about the same as in the Lombard Street Reservoir.

It is evident that Mr. Higgins' memory, as in several previous cases, did not serve him right after a lapse of 35 years, when, although not positive, he

thinks that on this structure consisting largely of arch-work, the brick-masons averaged about 1,200 bricks a day each.

5. San Andres Waste-Weir.

(h, Table XXVI.)

What Is Shown by Mr. Higgins' Testimony as to the Day Work on This Structure.

This structure was constructed in 1874-5 (Complainant's Test., pp. 820-27). Number of bricks required (Tables XX and XXVI), 696,000.

Mr. Higgins, from his recollection regarding the main and northerly portion of this structure, built fully thirty years prior to giving his testimony, says (Test. pp. 15 and 16):

"I was employed as foreman on the San Andres waste-weir, which was built in 1874 and 1875. Besides myself, there were three masons and eight laborers employed by the Water Company on that work."

"I would say that we averaged about 1,000 brick a day. We must have averaged, I think, from 1,000 to 1,200 brick a day to the man; but we will say 1,000 brick a day. I want to be on the safe side of this thing."

"That part of the waste-weir that took the part of the flume at the outlet and was constructed in 1874, the other portion was constructed in 1887."

Q. 49: "How many men were engaged on that work for the entire time?"

A. "There were four bricklayers, including myself, and eight helpers, or laborers, rather. I received $7 a day, and the other brick masons received $6 a day. Later on they paid me $200 per month. There were no hodcarriers engaged on the work, nor was there a carpenter; except, I will state this, that

at the outlet end of that tunnel, it was funnel-shaped, and they had carpenters to make a center for the inlet end of the waste-weir of that tunnel. It was a large center, and it was funnel-shaped, and it required a carpenter to do it. That was put up and we bricked it over."

Q. 50: "That was the customary way of bricking an arch?"

A. "Yes sir. We did it in the usual way, according to the engineer's instructions."

This testimony shows that Mr. Higgins' recollection, not only regarding the main or inlet portion of this work, which was constructed in 1874-5, but also regarding the outlet portion of the same, which was constructed in 1887, is rather indistinct and vague. He testifies that the outlet end (which is the lower end) of the waste-weir was constructed in 1874-5, or from 12 to 13 years prior to the main or inlet portion of this waste-weir, which he says was built in 1887.

Although he states that there was no carpenter there, he, Higgins, admits "that at the outlet end of that tunnel it was funnel-shaped and they had carpenters to make a center for the inlet end of the waste-weir of that tunnel." This is probably a mistake, as the funnel shape would be the inlet and not the outlet.

He does not state whose carpenters built the staging, both for the outside as well as for the inside of the large brick gate house at the inlet end of the waste-weir; nor how anyone but a carpenter or carpenters could have made the templets for the invert bottom arch, as well as for the arched side walls of the main tunnel, as well as the centers for the main top arch of the latter. It is therefore probable that he has either forgotten or has neglected to relate this portion of the carpenter work.

From the heretofore quoted portions of Mr. Higgins' testimony, it will be seen that, regarding the cost of labor on the original construction of both portions of this work (that of 1874-5 and of 1887), his testimony is very meager. He does not state whether or not complainant boarded all the men, including himself; nor what that board cost per day. He does not state what daily pay the hodcarriers, or helpers or laborers, received besides their board. Nor does he give the length of the day's work, neither for the portion built in 1874-5 nor for that of 1887. His statement as to the pay he received for himself of $7 a day, and, later on, $200 a month, does not make it clear whether the $7 a day was meant for the work in 1874-5, and the $200 a month for the work in 1887. He does not state what the services of the carpenters cost per day, nor what these services cost complainant per 1,000 bricks laid. He does not make any estimate as to the cost per 1,000 bricks laid, of bricks, cement and sand delivered at the structure.

The only thing on which he attempts to make a rough estimate, from memory, is as to what may have been the number of bricks averaged per bricklayer per day in this important hydraulic brickwork structure, the outlet portion of which was built about 18 years, and the main or inlet portion of which was built 30 years prior to the time when his testimony was given.

He testifies to nothing definitely. He thinks "they must have averaged" from 1,000 to 1,200 brick a day to the man; but he "will say 1,000 brick a day."

As a matter of fact, his last estimate of 1,000 bricks to the man a day is placed entirely too large for this class of hydraulic brickwork, in a tunnel, and practically all of it arch work (bottom, sides and top), which is necessarily much slower work than work in a straight wall.

That his whole testimony on this subject is guess work, however, is again shown by comparison with his average of 2,000 bricks a day per man in the much more difficult Six-mile house tunnel.

His whole testimony on this subject is vague, confusing and fragmentary, and affords no basis for estimating either original cost or present value.

6.* Bernal Tunnels.

(m, Table XXVI.)

What Is Shown by Mr. Higgins' Testimony as to the Day Work on These Tunnels.

These tunnels were constructed in 1884 et seq. (Defendants' Test., p. 2; Complainant's Test., pp. 1499-1500): Number of bricks required, 403,500 (Tables XXV and XXVI).

The method of constructing this important brickwork, completely enclosing the 44-inch Crystal Springs pipe line, which is carried through the same with water under pressure, is given in detail on page 991 of Mr. Schussler's testimony, and is briefly outlined in preceding pages of this brief. This description also shows the great difficulty and interruptions encountered and loss of time caused by the constantly alternating work between the boilermakers and the bricklayers and their helpers.

Where, under the present conditions of labor, in other tunnels (of about the same size as the Bernal Heights pressure tunnels) lined with first-class hydraulic brickwork, similar to that in the tunnels in groups A and B, Table XXIII (but without having a first-class 44-inch iron pipe built into the same), a first-class bricklayer now lays from 400 to 450 bricks in ce-

ment mortar, in a day's work of eight hours the same bricklayer, under the difficult conditions existing in the pressure tunnels will not, by a large percentage, be able to equal that daily performance in the plain, brick-lined tunnels of groups A and B in Table XXIII.

Regarding the amount of brickwork constructed by complainant by day's work in these pressure tunnels, so as to firmly secure the 44-inch pressure pipe within the tunnel, Mr. Schussler, in describing this class of brickwork, for the first of these pressure tunnels on the 44-inch Crystal Springs pipe line (1, in Table XXVI), the brickwork of which is identical with that in the other two pressure tunnels (m, in Table XXVI), says (Test., p. 991):

> "Thereupon the bricklayers came in. They had to wait for the boilermakers—they could not work while the boilermakers were fitting in the pipe. The bricklayers came in and built up the brickwork underneath the bottom and around the side of the pipe, building the pipe in solid in the tunnel, as this pipe in the tunnel was to be under pressure. The tunnel had to be so firmly built because it must be there for all time. There was much delay in this work. When the lower portion and the sides of the brickwork had been built in around the pipe they then had to cover the top of the pipe and turn the arches over the top of the pipe, and thus carefully fill in the entire space above the pipe and under the roof of the tunnel with first-class brickwork so as to brick up the tunnel solid."

Again, speaking on the same subject, he says (p. 1499):

> "The 44-inch wrought-iron pipe was laid through the same" (the tunnel) "in short lengths of one course each. They were then fastened together, split and calked and painted, and then surrounded with

a first-class body of brickwork, which filled the entire space inside of the timbering and outside of the 44-inch pipe."

"Bricking in the pipe solid, as heretofore described, required 403,500 brick."

On page 1499 Mr. Schussler gives the lengths of these two Bernal Heights pressure tunnels as 225 feet and 1120 feet, respectively, making a total length of 1,345 feet; which makes the number of brick required to fill in with solid brickwork the space between the outside of the 44-inch pipe and the inside of the tunnel average 300 bricks per lineal foot of tunnel.

As heretofore shown (and as fully detailed on pages 981 et seq, of Mr. Schussler's testimony), the single courses of which the Crystal Springs 44-inch pipe line is composed have a gross length of 44 inches, while, as riveted in the pipe (and allowing for the laps of the riveted round seams at the end of each course), each course has a net length in the pipe of 42¼ inches, or, in round figures, 42 inches, or 3½ feet. With the outer course made of plates 143 inches in length, and the inner course 142 inches, the outside circumference of the completed outside or large course (after allowing for the lap of the double-riveted straight seam) is 140 inches, which corresponds to a diameter of the outside of the large course (without the asphaltum coating) of 44.563 inches. The outside of the small course has a diameter of 3-8 of an inch less (being twice the thickness of the iron of 3-16 of an inch), or 44.188 inches. This makes an average outside diameter, between the large and small course, of 44.375, or 44 ⅜ inches, exclusive of the asphaltum coating; while, measured with the outer asphaltum coating, the average outside diameter between the large and small courses, as they are put

into these pressure tunnels, averages 44.6 inches. This average outside diameter of the asphaltum coated pipe represents an average cross-section or area of about 1,562 square inches, or, in round figures, 10.80 square feet.

Complainant's Exhibit No. 52, gives a cross-section of these pressure tunnels, which shows that they were constructed in hexagon form. In the center of these hexagon shaped tunnels the 44-inch pipe was built solidly into the brickwork, which brickwork fills the entire space between the outside of the 44-inch pipe and the inside of these hexagon-shaped tunnels. Although no dimensions are written into the diagram (Exhibit 52), representing the shape and size of these pressure tunnels, a scale is attached to them. Measured by this scale these tunnels have a clear height of 5.75 feet, a bottom width of about 4.6 feet; a top width of about 3.4 feet, and the greatest width of the hexagon of 6.1 feet is at about 3.25 feet above the bottom of these tunnels. By these dimensions it is shown that the area within the hexagonal outline of these tunnels amounts to 29.20 square feet.

Exhibit 52 furthermore shows that immediately surrounding the outside of the 44-inch pipe (which, with its asphaltum coating, occupies, in round figures, 10.8 square feet of the 29.2 square feet area of the hexagonal tunnels) the arched portion of the brickwork consisted of three concentric rings of brick, which, with their three mortar joints, occupied a thickness of fully 13 inches around the outside of the pipe. The outer circle of this 13-inch, three-ring brick arch, which completely surrounds the outer diameter (of 44.6 inches) of the 44-inch pipe, practically touches the bottom, top and sides of the hexagon-shaped tunnel, thus leaving but six small, almost triangularly shaped spaces between the

outside of this 13-inch triple brick ring and the inside of the tunnel. The solid brickwork outside of these three arched rings (referred to on page 991 and at other places of Mr. Schussler's testimony) occupies, as shown on Exhibit 52, six narrow spaces between the inside of the tunnels and the outside of these three (3) concentric rings of brick masonry.

By deducting the average area occupied by the asphaltum coated 44-inch pipe of 10.8 square feet from the area contained within the hexagonal shape of the pressure tunnels (as shown in Exhibit 52), and without making any additional allowance for the brickwork filling the bottom drain or trench, nor where the tunnels exceeded the dimensions of the tunnels (as shown in Exhibit 52) of 29.2 square feet, we have 29.2 less 10.8, or 18.4 square feet of area outside of the pipe and inside of the tunnel that is filled solidly with hydraulic brick masonry. The area of 18.4 square feet of brick masonry makes for every running foot of these pressure tunnels an average of 18.4 cubic feet of brick masonry.

Of these 18.4 cubic feet of brick masonry per lineal foot of these tunnels, 16.4 cubic feet are represented by the three (3) concentric brick arches, of a joint thickness of fully 13 inches, while the remaining two cubic feet of brickwork per lineal foot of tunnel gives the average brickwork of solid filling foot between the outside of these three brickwork rings around the pipe and the inside of the tunnel.

Although Mr. Higgins, when speaking of the brickwork in these pressure tunnels, assumes that the average cubic foot of this brickwork, as laid in its cement mortar bed, contains 18 bricks per cubic foot, or 12 bricks for every two-thirds (2-3) of a cubic foot (De-

fendants' Test., p. 24), this brickwork, according to Mr. Schussler's testimony and to Exhibit No. 52, above described, contains less than 17 bricks to the average cubic foot of masonry laid in these pressure tunnels. This will be seen by dividing the number of cubic feet of solid brick masonry, laid in the two Bernal Heights pressure tunnels, into the total number of bricks required for the same, thus: Total lengths of both tunnels, 1,345 feet; cubic feet of brickwork contained in the running foot of tunnel, 18.4 cubic feet; 1,345 times 18.4 equals 24,748 cubic feet of brick masonry. Total number of bricks required in these two pressure tunnels, 403,500 bricks, which, divided by 24,748 cubic feet, gives 16 3-10 bricks per cubic foot of brickwork.

By multiplying the number of cubic feet of brickwork per lineal foot of tunnel of 18.4 cubic feet with the average number of 16.3 brick per cubic foot of masonry, we have 299.92, or, in round figures, an average of 300 brick required per lineal foot of tunnel to solidly fill the space within these pressure tunnels, and outside of the 44-inch pipe line, firmly imbedded in this hydraulic brick masonry.

This is the same average reached by Mr. Schussler in his testimony (p. 1500).

Mr. Higgins, when asked whether he did the bricking of the pipe in these tunnels, says (p. 24):

> "Yes, I did, but it was not done under contract. It was day's work. I started the work. I was there twenty days, and then I went on other work. The same men stopped there and finished the tunnel. I got over there every chance I had to see them. I did not finish it, I only started it."

Mr. Higgins does not state how many days or months were required at that time (between 1884 and 1886) to

complete all of this brickwork in these two tunnels, aggregating 1,345 feet in length; he worked there at the start for 20 days only, and he only started the work, but did not finish it.

He was asked by defendants' counsel his estimate of the cost complete, and was shown a memorandum purporting to have been made by himself at the time. He answered (p. 24):

> A. "Yes, I made this out. That pipe is 3 feet 8 inches in diameter; add 8 inches to that, and take three times that and you will get the circumference of that as 13 feet. Twelve brick to the foot gives me 156 brick to the foot, or 1404 brick for 9 feet. There were employed in doing 9 feet of masonry the following: 2 masons, one day, $12."

Again, referring to the manner in which he arrived at the 156 bricks, which he assumes to be the number of brick in these tunnels per lineal foot, he says (p. 25):

> "I figure that we laid 156 brick to the foot, which would mean a total, for 1,345 feet, of 209,820 brick."
>
> Q. 63: "Was the back-filling of brick or of earth?"
>
> A. "We set the two rings of brick about the pipe and then had it filled in with earth. There was no back-filling of brick."

The memorandum, which he says was made out by himself at the time, shows on its face that it was not made when the work was in progress, but at some subsequent period, when his recollection of the circumstances and details had become faded. If it had been made at the time when this brickwork was in progress, he would not have been likely to have committed the error of assuming that there were only two concentric rings of brick masonry around the pipe, instead of the three rings, with additional outside brickwork filling;

nor would he have called the outside diameter of the pipe "3 feet 8 inches," or 44 inches, where it actually averages 44 6-10 inches; nor would he, when speaking of the joint thickness of two rings of brick masonry, with their mortar-joints, have called it 8 inches, when, as a bricklayer, he knows, or should know, that this thickness is about 9 inches instead; nor would he have guessed at the diameter of the center line of his double brickwork lining, at 44 plus 8 inches, or 52 inches, when, in reality, it would be 44.6 plus 9 inches, or 53.6 inches; nor would he, in order to obtain the circumference of this central circle of the double brickwork ring, have multiplied his assumed diameter of 52 inches by three, thus obtaining his assumed circumference of 13 feet, when, in reality, the actual diameter of 53.6 inches (in order to obtain the circumference), must be multiplied by 3.14159, thus giving, instead of Mr. Higgins' assumed circumference of 13 feet, the actual circumference of 14.03 feet, or, in round figures, of 14 feet.

As hereinbefore shown from Mr. Schussler's testimony and complainant's Exhibit No. 52, the pipe line was bricked solid into these tunnels, requiring for each lineal foot of pipe and tunnel an average of 18.4 cubic feet of brick masonry.

According to Mr. Higgins' recollection or assumption, two-thirds (2-3) of a cubic foot of the brickwork in this tunnel took 12 bricks. Thus one cubic foot, according to him, would take 18 bricks.

The 18.4 cubic feet of brick masonry required to solidly fill the entire space between the outside of the asphaltum-covered pipe and the inside of the tunnel, would, at the rate of Mr. Higgins' 18 bricks per cubic foot, require about 331 bricks per lineal foot of tunnel, instead of the 156 bricks, which latter, as he figures it,

represents the number of bricks per lineal foot of tunnel, while, as shown in Mr. Schussler's testimony and in Exhibit No. 52, the brickwork in this tunnel requires an average of 300 bricks to the lineal foot of tunnel.

Speaking of the length of each separate course of pipe, as put into these tunnels, Mr. Higgins says (p. 25):

> "The masons could not lay any more brick than boilermakers put in pipe for. They put in three pipe a day. There was one machinist and two laborers employed in putting in three pipe a day. That is what they did for a day's work; not any more or less.'

In reference to a day's work of two bricklayers, he says (p. 24):

> "Twelve brick to the foot gives me 156 brick to the foot, or 1404 brick for 9 feet. There were employed in doing 9 feet of masonry the following:
> 2 masons, one day $12
> 4 laborers, one day ..... 9."

And he gives this (p. 25) as an "average of 700 brick per man."

If Mr. Higgins' memorandum had been made at the time when the work was actually in progress, he would not have assumed that the three lengths of pipe, which the boilermakers could put into the tunnel in a day's work ("not any more or less") equaled nine feet; as this would make the length of each of the three pipes three feet only. As shown from Mr. Schussler's testimony (p. 982), these lengths or courses of pipe were not three feet, but 3 feet 6¼ inches, or, in round figures, 3½ feet.

The question, therefore, arises whether Mr. Higgins

means to say that the bricklayers bricked into the tunnel three lengths of pipe in a day (which three pieces actually measure about 10½ feet), or whether he means to say that the boilermakers put in three pipes a day (which is 10½ feet of pipe); but that the bricklayers covered with brickwork only nine feet in a day out of these 10½ feet of pipe that the boilermakers had laid for them.

Mr. Higgins is very emphatic in saying that the boilermakers could only put in "3 pipe a day" into the tunnel, and that the bricklayers could not put in the brickwork any faster than at the rate that the pipes were put in.

Mr. Higgins, having apparently assumed that the three pipes put into the tunnel in a day had a total length of only 9 feet, and that he laid only two four-inch rings of brick around the pipe, and that he filled the balance of the tunnel with earth, figured that it took about 156 bricks to the running foot of pipe and tunnel, and comes to the conclusion that the day's work of bricklayers (limited by the daily length of pipe put in, and by the thinness of the 8-inch brick arch, which he thinks he put around the pipe), consisted of 9 times 156, or 1,404 bricks a day, laid in the tunnel. Assuming that he only employed two bricklayers to do the brickwork, he concludes that the average day's work of each bricklayer in this structure must have been 700 bricks a day.

As each separate length or course of this pipe is fully 3½ feet long, and consequently three courses, connected together in the tunnel form a length of about 10½ feet, it would require to fill the entire space left between the outside of the pipe and the inside of the tunnel 300 bricks to each running foot of pipe and tunnel, or 3150

bricks to each 10½ feet of pipe, and Mr. Higgins' assumed daily nine feet would require 2,700 brick, instead of his assumed or figured 1,404 bricks.

If, therefore, for argument's sake, there were employed only two bricklayers to keep up with the boilermakers, who, according to Mr. Higgins, were putting 9 feet of pipe a day into the tunnel, these two bricklayers, laying 2,700 bricks a day, would each have had to lay the impossible number of 1,350 bricks a day.

If, on the other hand, he insists upon his statement that the boilermakers put in three lengths of pipe a day (which actually represents a total length of fully 10½ feet, instead of 9 feet), then the two bricklayers would have had to lay daily 3,150 bricks, or 1,575 bricks per man per day.

The fact that Mr. Higgins only started this brickwork in the Bernal Heights tunnels; that he was there only twenty days; that he did not finish the work; and that about twenty years have elapsed since this work was done, explains to some extent the great discrepancies between Mr. Higgins' assumptions, recollections and figures, and the facts as they exist.

That Mr. Higgins, while testifying, appreciated the fact of the very much greater difficulty and expense encountered for labor when laying brick in the pressure tunnels, as compared with the Six-mile House tunnel on this pipe line (which is of similar size, but does not require the 44-inch pipe to be bricked into the same), is evidenced by the fact that, although his figures as to the number of bricks laid daily in both cases are far beyond the bounds of possibility, they show that in his opinion a bricklayer in the pressure tunnels could lay in a day's work only 35 per cent of the number of bricks which he could lay in the easier Six-mile House tunnel.

Mr. Schussler's estimates do not make the difference so great. His testimony (pp. 1,000 and 994) shows that a first-class bricklayer's day's work in the pressure tunnels equals about 75 per cent of the number of bricks which could be laid in the Six-mile House tunnel.

The foregoing analysis of Mr. Higgins' testimony on the subject of the brickwork in these pressure tunnels shows that the same is, to say the least, very vague; that his figuring of the number of bricks laid per lineal foot of tunnel appears to be based, not on facts, but on erroneous assumptions and vague recollections, and that therefore his testimony on the subject of the brickwork in the pressure tunnels is unreliable and without value for the purpose of ascertaining either the original cost or the present value of this work.

7. The Gate Shaft and Tunnels at Crystal Springs Main Dam.

What Is Shown by Mr. Higgins' Testimony as to Day Work on These Structures.

These structures were constructed in 1887-8 and 1890 (i, Table XXVI). Number of bricks required 940,000 (Complainant's Test., pp. 925-9).

In regard to this brickwork structure, Mr. Schussler says (Test., pp. 932-5):

> "The next large piece of work of importance consisted of the outlet shaft, tunnels, pipes and gates, of which I file here a diagram, which will be 'Complainant's Exhibit No. 49.' This diagram shows, in the upper left-hand corner, a general cross-section of the rocky bluff which forms the north end of the dam, or, in other words, the abutment against which the Crystal Springs dam butts at its north end. It shows a vertical shaft cut out of the solid rock and bricked

up with the first-class brickwork. From the bottom of this shaft it shows a tunnel, laid up in first-class brickwork, leading to the outlet, at the right hand of this profile, and it also shows on the lake side, that is on the left side of the picture, inlet tunnels which contain 44-inch heavy cast-iron flange pipes, bolted together and thoroughly bricked into these tunnels. At the extreme ends of these, and within the reservoir, there are vertical towers, which have cast-iron 44-inch pipes inside of them, and each one of them has a brass polished top, on to which large fish screens are located, so as to prevent fish from getting into the pipe. We have three of those inlets on the lake side of the deep tower, the two lower ones being tunnels, while the upper one is a shorter inlet, of which I shall show photographs hereafter. On the same left side of this exhibit is the cross-section of the brick tunnel leading out from the base of this gate-tower to the outlet of the tunnel, and in this tunnel is placed a 54-inch wrought-iron pipe. The next picture on this exhibit shows the outlet of this tunnel and the gate-house at its outlet on a larger scale. It shows a brick building, with a wooden building over it, which has been since replaced by a brick building with steel I-beams. It also shows a concrete foundation underneath this outlet gate-house. This gate-house contains the regulating gate by which regulating gate the exact amount of water to be sent to San Francisco is regulated by the keeper. Lower down is shown a top view and a cross-section of the gate, and also a view of the hoisting gear. On the right side of this Exhibit 49 is shown the same gate-tower on a larger scale, with the various inlet tunnels, cast-iron pipes and fish screens, as well as with the separate regulating gates in the gate-tower at each end of these outlets. It also shows the cast-iron standpipe, which is bricked in solid in the gate-tower, and shows the wrought-iron standpipe and the ladder that reaches toward the top. All of this work is very thoroughly done. These heavy

gates at each one of these stations rest on strong I-beams built firmly in the wall. The idea of these gates is that the water can be drawn from any portion of the lake, or from any of these levels. Water can be drawn from the upper stratum, if necessary, or from the middle or the lower. I file this diagram as "Complainant's Exhibit No. 49."

From this detailed description, as well as from Exhibit No. 49, it will be seen that all of the brickwork comprised in this structure is arch work, and, as nearly all of it, except the upper end of the main shaft and the small inlet and outlet wells consists of arch work performed underground, the number of bricks that a brick mason can lay under these conditions, of this high-class hydraulic brickwork, is less than that laid in the same class of work, but in the open.

One feature of this work in the tunnels, which makes the labor of part of this brickwork very difficult, slow and expensive, is the bricking with solid masonry, as shown on Exhibit 49, into the two intake tunnels, of a total length of 224 feet, of the very heavy flanged 44-inch cast-iron pipe, in short lengths. This brickwork, having to be performed inside of small tunnels and in the very cramped spaces left outside of the heavy cast-iron pipe, and having to be done in an alternating way, between machinists' and bricklayers' work, is of necessity difficult, which accounts materially for the decrease in Mr. Schussler's estimate of the average daily performance per bricklayer in the entire combined shaft and tunnel structure, to about 500 bricks to an eight-hour day's work.

Extracts from Mr. Schussler's estimate of present cost of labor for reproduction of the hydraulic brickwork contained in the gate-shaft and tunnels at the Crystal Springs main dam are as follows (pp. 927-9):

Bricklayers, per day of 8 hours	$6.00	
Board, 80 cents per working day; Total cost per day	6.80	
A bricklayer lays 500 bricks per day of 8 hours in this work, which makes the cost of bricklayers per 1,000 bricks laid		$13.60
For every 5 bricklayers there are required 3 hodcarriers and mortar men, who attend on them, at $3.50 a day, and 80 cents for board, or $4.30 a day each. This makes $12.90 a day for the 3 hodcarriers and mortar men required while 5 bricklayers lay 2,500 bricks;		
Making the cost of hodcarriers' and mortar men's work per 1,000 bricks laid	$ 5.16	
These 3 hodcarriers and mortar men are assisted by 5 laborers at $2.50 a day each, including board, being $12.50; or, per 1,000 bricks laid		5.00
One carpenter at $4.00 and one laborer helping him, at $2.50 a day (both including board), attend to all templets, centers and scaffolding in tunnels and shaft; which total cost of $6.50 a day, connected with the laying of 2,500 bricks, making this part of the work cost, per 1,000 bricks laid		2.60
Total labor per 1,000 bricks laid in the shafts, main tunnel and intake pipe tunnels		$26.36

The present cost of materials used in the construction of this important work (such as brick, cement and sand) has been fully discussed heretofore and tabulated (sub. 1) in Tables XVIII, XXIV and XXVI.

The following analysis of the testimony of defendants' witness, Mr. Higgins, will show the manner in which he attempts to arrive at the original cost of labor in this structure.

Mr. Higgins says he was employed in drifting and bricking the Crystal Springs tunnel in 1887 (Test. p. 27).

Regarding the brick work, he gives no facts as to the important item of day's wages paid to the bricklayers employed in this work, or to the men who helped the bricklayers. The only mention he makes of any wages in connection with the work of drifting and bricking during the period when this work was going on, in 1887-8, is what he says about his own wages and about the wages paid to the men who drifted the tunnel.

He quotes the price of the board of these men, and, after giving the number of men with which he started the work of drifting, he gives the pay which the men on the cars and the roustabouts received. His testimony on the subject is as follows:

> "The men employed in the drifting of the tunnel were paid $2.00 a day and board. The contract for boarding the men was let to a man by the name of Price. He got $4.00 a week for each man. I started in on that work as foreman, with 20 men under me. The men on the cars, and the roustabouts got $40 per month and board." (Test. p. 27.)

> Q. 74: "You also had charge of the bricking of said tunnel and you kept an account of the expenses thereof, did you?"
> A. "Yes sir."

> Q. 75: "Will you give us the cost of the labor employed on that work, the bricks used, and also the number of barrels of cement?"

A. "Yes sir. There were $16,000.95 for masonry work on that tunnel, as follows:

November	$ 1,012.35
December	1,628.55
January, 1888	2,468.75
February	2,093.00
March	1,209.45
April	707.30
May	1,428.70
June	1,684.45
July	1,744.60
August	1,612.15
September	420.25
Making a total of	$16,009.55

There were 1,050,000 bricks."

Q. 76: "How many barrels of cement?"

A. "2257 barrels."

Q. 77: "That is for what you call the Crystal Springs tunnel, but which is, in reality, the forebay and the outlet of the Crystal Springs Reservoir, as described by Mr. Schussler in his testimony?"

A. "I presume so, yes." (Test., p. 29.)

* * *

"Cost of labor in laying brick, $16,009.55."

Q. 81: "You say that is the cost for as much of the work as you did. What do you mean by that?"

A. "I mean I do not include the cost of some subsequent work which was done on the top of the shaft. I did all this work on that tunnel with the exception of raising the top of the shaft." (p. 30.)

The above quotations from Mr. Higgins' testimony contain all of the information that Mr. Higgins gives on the cost of the brick work in this structure.

He places the number of brick laid by the bricklayers in the shaft and tunnels, in 1887-8, while he was employed by complainant as foreman, at 1,050,000 bricks.

As shown by Mr. Schussler's testimony, the total number of brick contained in this entire structure (in 1903-4) in its present condition, is 940,000. This includes fully 80,000 bricks, which as heretofore shown in this brief under the head of "Days work" were laid in this work in the year 1890, about two years after Mr. Higgins ceased to work for complainant. Deducting these 80,000 bricks from the total number of 940,000 now composing this entire structure, we have the total number of brick laid during Mr. Higgins' time, in 1887-8, of 860,000 brick, and not 1,050,000 brick, as Mr. Higgins has it in his testimony.

As to the work of the bricklayers, Mr. Higgins does not give the number employed at any one time, nor the total number of days' work of bricklayers required to do this work, nor the number of days' work of laborers who acted as helpers to the bricklayers, nor the wages of either the bricklayers or laborers.

These bricklayers, about whom Mr. Higgins does not give any information whatsoever, laid these 860,000 bricks during the period from November, 1887, to September, 1888.

By dividing Mr. Higgins' erroneous total number of 1,050,000 bricks into the $16,009.55, which he gives as the total cost, it would appear the cost of labor of laying the brick in this difficult tunnel and shaft work was only $16,009.55 divided by 1,050,000 bricks, or $15.24 for labor per 1,000 bricks laid.

As Mr. Higgins does not give any data necessary to arrive at the correct cost of labor per 1,000 bricks laid, we have to use the data obtainable from the brick work done in the same year (1887) at the San Andres waste-weir, as to wages as well as to the number or proportion of laborers that assisted the bricklayers in the construction of the latter piece of brick work.

According to Mr. Higgins' testimony (pp. 15-16) there were working, in 1887, at the brick work of the San Andres waste-weir, Mr. Higgins and 3 bricklayers. These 4 bricklayers required 8 laborers to help them; or two laborers to each bricklayer. It is quite likely that a similar proportion between bricklayers and laborers was maintained in the Crystal Springs brick structure (which was begun in the same year), although, on account of the much more difficult brick work in the 224 feet of inlet-pipe pressure-tunnels at Crystal Springs, this portion of the work was more difficult, slow and costly than the rest of the work, as to the number of bricks laid per bricklayer per day.

It appears that while at San Andres waste-weir Mr. Higgins himself worked as a bricklayer with the other three journeymen bricklayers (the latters' wages being $6 a day). He does not state, in his testimony regarding the Crystal Springs shaft and tunnels, whether he himself also laid brick at this place. As foreman, however, it is not likely that he laid brick himself. As, according to his testimony, he received $200 per month as foreman, for drifting the tunnels, it is probable that as he continued in complainant's employ as foreman of bricking, after the drifting was finished, the same wages of $200 a month also continued. According to his testimony, the work of bricking seems to have required fully nine months' time, during which his wages would amount to at least $1,800, and his board for nine months, or about 38 weeks, at the rate of $4 a week, would cost $152, or, in round figures, $150, which makes his wages and board combined not less than $1,950.

Besides this item, there is the board of the men, which complainant furnished outside of the wages paid to them. This board, Mr. Higgins quotes at four

dollars a week per man. As Mr. Higgins does not give the wages paid to the bricklayers at Crystal Springs, it is fair to presume that they received the same wages of $6 per day, as at the San Andres waste-weir, which had just been completed in 1887.

Mr. Higgins being also silent as regards the wages paid to the laborers, who helped the bricklayers in the tunnels and shaft, it is fair to presume that they received the same pay as the men who had helped the men who drifted the tunnels just prior to the bricking, which pay was, according to Mr. Higgins, $40 a month (or $1.54 per day), to which must be added the cost of their board.

On the basis of the same proportional division of labor between bricklayers and the laborers who helped them with the materials, as practiced in the same year at the San Andreas waste-weir, of 1 bricklayer to 2 laborers, we have, with the above respective rates of day's wages:

1 bricklayer at $6.00 per day.....	$6.00
2 laborers at $1.54 per day.....	3.08
Total	$9.08

which would represent the total day's wages paid to this group of three men.

To ascertain, as nearly as practicable, the number of days' work of both bricklayers and laborers employed on the entire structure erected during Mr. Higgins' time, in 1887-8, and assuming that Mr. Higgins' total of $16,009.55 paid to the men is correct, we have to divide this total sum of $16,009.55, paid, according to Mr. Higgins, for this labor, by $9.08, which represents the total days' wages of each set of 1 bricklayer and 2 laborers combined. The result obtained by this

division would give, as near as practicable, the total number of days' work of bricklayers that were required to lay the 860,000 bricks which were laid in this structure during Mr. Higgins' time, in 1887-8, thus: $16,009.55 divided by $9.08 is 1,763, or, in round figures, 1,760 days' work of bricklayers.

As to each day's work of bricklayer, there would be two days' work of laborers, the total number of laborers' day's work would be about 3,520 days' work of laborers.

For the cost of board of these men, at four dollars a week, paid at that time, we have 1,760 bricklayers' days' board, and 3,520 laborers' days' board, or a total of 5,280 days' board.

At four dollars a week (of six working days each) the days' board per man equals 66 2-3 cents a day, making the total cost of board for the above 5,280 days amount to $3,520.

By adding together the above three items:

For labor	$16,009.55
For Mr. Higgins' wages and board	1,950.00
For board of bricklayers and laborers	3,520.00
We have a total of	$21,479.55

or, in round figures, $21,400.

This sum, in all probability, represents, as near as practicable, the cost of labor connected with the laying of the 860,000 bricks placed in this structure during Mr. Higgins' time, in 1887-8, exclusive of incidental, contingent, superintending and engineering expenses.

By dividing the above sum of $21,400 by 860 thousand bricks laid, we have $21,400 divided by 860, or $24.88 as the cost of labor per 1,000 bricks laid in Crystal Springs tunnels and shafts, and not $15.24, as might

be inferred from Mr. Higgins' very fragmentary and incomplete testimony. In this latter result, the fact that he erroneously assumes that he laid 1,050,000 bricks, instead of actually having laid only about 860,000 bricks or 190,000 less, plays an important part.

Mr. Schussler's estimate of the cost of labor connected with this brick work if reconstructed in 1903-04 is $26.36 per 1,000 bricks laid (sub. i, Tables XXIII, XXIV and XXIX), which, under the materially altered conditions of labor, wages and length of day's work, compared with 1887-8, is only about $1.50 higher per 1,000 bricks laid than the original cost, in 1887-8, of $24.88 deduced from Mr. Higgins' testimony, coupled with the correction of the grave error of 190,000 bricks, which Mr. Higgins assumes are contained in this structure in excess of the number which it actually contained.

The above analysis of Mr. Higgins' testimony, coupled with the correction of the large error which he makes in the number of bricks laid during his time, shows that, instead of $15.24 per 1,000 bricks, the total cost of labor, inclusive of board, was, at that time, in all probability, about $24.88 per 1,000 bricks laid, or fully 60 per cent greater than his testimony appears to indicate.

Mr. Higgins' testimony regarding the cost of labor in the original construction of the hydraulic brick work in complainant's shaft and tunnels at the Crystal Springs main dam, is fragmentary, vague and erroneous, and, without the above corrections by complainant, cannot be used in ascertaining the original cost of this structure, nor its present value.

In the foregoing detailed analysis of the testimony of defendants' witnesses it has been conclusively shown that the testimony of Mr. Carey, as to hauling; and of

Mr. Higgins, as to the cost of materials delivered at the respective structures; the number of brick laid per bricklayer per day, in these respective structures; the cost per 1,000 bricks of all labor performed in laying the same in the structures; the quality of the bricks used in these structures and the number of bricks used in each respective structure, is fragmentary, vague, confused and unreliable, and is therefore of no value whatsoever, either for the purpose of arriving at the original cost of these structures, or to establish the cost of their reproductions under the present conditions of cost of materials, and of the cost of labor performed.

XVI.

Drifting of Tunnels.

Analysis of the Testimony as to the Labor Cost on This Portion of the Structures.

Bald Hill Tunnel and Pilarcitos Tunnel No. 2

Defendants' brief, on page 399, quotes from page 864 of Mr. Schussler's testimony regarding the Bald Hill tunnel, as follows:

> " 'The drifting of this tunnel at that time when it was drifted cost between $10.50 and $11.00 a running foot, inclusive of timber. It can now be done for about $9 a running foot.' "

Counsel for defendants then quote from what they assert to be the minutes of the Directors, a statement that the contract for drifting this tunnel had been let at $8.50 per lineal foot.

They do not state whether the minutes or the contract provided for who was to furnish the timbers and the labor of timbering of this tunnel or whether extra

compensation was paid to the contractor for this material and extra work, and, if so, how much; or whether complainant, or the contractor, furnished the track, cars and tools. The inlet or westerly half of this long tunnel had to be drifted from the bottom of the deep San Andreas brick outlet shaft (f. in Tables XXIV and XXVI of this brief), requiring the hoisting by hand windlasses of all of the materials blasted and excavated out of this half of the Bald Hill tunnel, which has a total length of two thousand eight hundred and twenty feet, and all the timbers and other materials needed had to be lowered in the same manner, down to the men at the tunnel inlet level. Counsel for defendants do not state in their brief who paid for all this extra labor.

The statement made by Mr. Schussler on page 864 of complainant's testimony and quoted on page 399 of defendants' brief, that "the drifting of this tunnel at that time when it was drifted cost between $10.50 and $11 a running foot, inclusive of timbering," referred to the total cost per running foot of tunnel, inclusive of all drifting, blasting, track, cars, tools, timbers, lagging, labor of erecting the timbering in the tunnel, hoisting the excavated materials out of the shaft and lowering the timbers and lagging down the shaft to the tunnel.

In making his estimates for the cost of reproduction of the drifting and timbering of this same tunnel in 1903-4, Mr. Schussler discards whatever information he had about the original cost. He takes into consideration both the improved method of blasting with single hand-drills and giant powder, over the former and more expensive methods, which he afterwards describes (p. 2453) and also increase in wages of miners since the original drifting of the Bald Hill tunnel, and

says: "It (the drifting) can now be done for about $9 a running foot," which includes timbers, timbering, hoisting, etc.

In view, however, of the fact that Mr. Schussler's estimate of $9 per foot for reconstruction is considerably less than the original cost as stated by him, his statement as to the original cost is unimportant.

Lake Honda Tunnel.

Regarding the drifting of the Lake Honda tunnel, defendants' brief (p. 377-8) says:

> "The minutes show, however, that the same Mr. de Noon, to whom Mr. Schussler refers, contracted for the Lake Honda tunnel, timbered, at $8 per foot. As Mr. Schussler's estimate for this tunnel is the same as for the two Pilarcitos tunnels, the same cost price must be assumed. If Mr. Schussler's memory of the cost price is erroneous to the extent of $3.50 per foot, what shall be said of his other estimates based on recollections?
>
> "The minute record referred to is found in Book 'B,' pp. 234-5 and is as follows:
>
> " 'November 15, 1866. The President reports that he has given the contract of the Lake Honda tunnel to Mr. R. P. De Noon at $8 per lineal foot, timbered.' "

Counsel do not quote Mr. Schussler's testimony in regard to the drifting of the Lake Honda tunnel, which reads as follows (pp. 789-790):

> "Continuing my description of the Lake Honda tunnel, the tunnel was drifted and timbered the entire way. It was drifted with a bottom width of 5 feet 6 inches and a top width of 4 feet 6 inches and a height of about 6 feet, making an ideal area or cross-section of 30 square feet. The cost is estimated at $9 per lineal foot, including timbering, blasting,

etc. A portion of this tunnel was in bedrock, which occurs in the neighborhood, and a portion of it is in sand. We had considerable trouble there with caving and we had to spile it to keep it from caving in on us. 2,820 feet at $9 per foot, $25,380."

As shown on page 2451 of complainant's testimony, practically the entire 3420 feet of length of Pilarcitos tunnel No. 2 was drifted and blasted through rock, some stretches of it being hard rock, while, as shown above, only a portion of the Lake Honda tunnel was in rock, while the other portion was in sand. The contractor, Mr. de Noon, having had experience in the same year (1866) with drifting of the Pilarcitos tunnel No. 2, 3420 feet in length, and of the same cross section of thirty square feet as that of the Lake Honda tunnel (2,820 feet in length), may have assumed, from the outside appearance of the flat ridge through which the latter tunnel was to be drifted, that it would be all or nearly all of a sandy character and perhaps very little, if any, of bedrock, and have therefore been induced to take the contract for the Lake Honda tunnel at the low figure of $8 per lineal foot.

As long as defendants' counsel seem to have had access to the minute books of the Directors it would be of interest to know if it could have therein discovered, if possible, what this tunnel actually did cost to drift per running foot and whether the contractor, who had much trouble with the caving in of the sandy part of the tunnel, made or lost money on this job, which he had taken at the low figure of $8 per running foot, or, whether the minute books give any subsequent information as to whether or not the complainant came to the contractor's relief in respect to that.

Furthermore, counsel having had access to complainant's minute books, it is strange that where they found

the contract price for the Lake Honda tunnel, and quoted and commented on the same, they did not also quote from the minute books the contract price for which Pilarcitos tunnel No. 2 was let to the same Mr. de Noon only about a year previously.

Six-mile House Tunnel.

Regarding the drifting and timbering of this tunnel counsel in their brief (p. 319) say:

> "Table No. 16 sets forth the estimates on the drifting, timbering and bricking of this tunnel, together with figures on cost supplied by Mr. Higgins, the contractor. It is noticeable that Mr. Schussler's estimate nearly doubles the cost."

In this paragraph they assume, without further comment, that Mr. Higgins' figures for the drifting as well as the bricking of this tunnel, actually represent the cost of the same.

We have shown in preceding pages of this brief that Mr. Higgins' figures, both as to the drifting and timbering and as to the bricking of this tunnel, are incomplete, conflicting, based on erroneous assumptions of fact and wholly unreliable.

Bernal Heights Tunnels.

Counsel for defendants, on page 286 of their brief, make the following statement:

> "These are two tunnels leading the extension of the Crystal Springs 44-inch pipe through two ridges at Bernal Heights, which are included by Mr. Schussler in his estimates on the city pipe system under the classification of 'Special Structures.' Following will be found Table No. 11, giving the estimates submitted on drifting and bricking of these tunnels,

together with figures on cost supplied by Mr. Higgins, who did the work under contract. It will be noted that the difference between Mr. Schussler's estimates and cost given by Mr. Higgins equal $19,599.88, being an increase over 100 per cent on cost."

Mr. Higgins' own testimony shows that he did not, as asserted by counsel, perform the work "under contract." He claimed that he did the drifting under contract, but as to the bricking he says "it was not under contract. It was day's work." (Test. p. 24.)

In reference to the drifting of these two tunnels, Mr. Higgins' testimony is conflicting. On page 23 he says his contract was $7.75 per lineal foot, but on page 25 he says "the drifting was $7.87½."

He does not state, in his testimony, at what rate of wages per day or cost per lineal foot he counts the value of his own time, when he says, on page 23: "I employed nine men on the work and paid them $2 per day and board." He does not state whether he worked the drifting of these tunnels from both ends at the same time, as is customary in all of complainant's tunnel work. He does not state how many shifts of men he had drifting the tunnels in each of the respective faces of the drifts of these tunnels during each twenty-four hours; nor how many men to each such shift; nor the number of hours constituting each shift; nor does he give the number of men employed for each drift in running the cars, with which the excavated work is brought to the outside, and timbers, etc., are taken into the tunnel.

On account of the lack of detailed information as regards the above matters, it is impossible, based upon Mr. Higgins' meagre data, even if correct, to estimate therefrom what the cost of this work of drifting and

timbering would be under the present conditions (in 1903-4) of organized miners' labor, which also defines the length of a miner's day's work, and requires higher wages than claimed to be paid by Mr. Higgins in 1884 for the labor employed in these tunnels.

Much of the difference, however, between Mr. Higgins' figuring and Mr. Schussler's estimate is due to the fact that Mr. Higgins allows for only about one-half of the brick that is actually required to brick these tunnels. Mr. Higgins, speaking from recollection and from erroneous estimates made by himself of the dimensions of the space to be filled with brick, estimates the number of brick laid as 209,820, while in our previous analysis of the brick work in these tunnels we have shown that it takes over 403,000.

Outlet Shaft and Tunnels, Crystal Springs Main Dam.

Counsel for defendants, on page 306 of their brief, begin as follows:

> "Table No. 15 gives a comparison of cost figures and estimates on the drifting and bricking of these outlet works, showing the usual extravagance of Mr. Schussler's estimate."

The testimony of Mr. Higgins, who is defendants' sole witness, as to the actual work of drifting and bricking this structure, has been thoroughly analyzed in our discussion of the brick work, where we have shown his figures to be absolutely unreliable.

Regarding the drifting of the tunnels and shaft at Crystal Springs main dam, Mr. Higgins says (Test. pp. 27-8):

Q. 67: "In what year was that in?"

A. "In 1887. The men employed in the drifting of the tunnel were paid $2 a day and board. The contract for boarding the men was let to a man by the name of Price. He got $4 a week for each man. I started in on that work as foreman, with 20 men under me. The men on the cars and the roustabouts got $40 per month and board. I understood at first that work was to be done by contract; finally Mr. Schussler told me that he was not going to let the work by contract, and asked me if I wanted to go down and do it by the day. I said 'yes.' He said, 'What wages do you want?' I said, '$200 per month.' He said, 'You go and do it, and do it the same as if you were under contract and let nobody know the difference. You will be under George'—meaning his brother, George Schussler. The tools used on the work I sold to the water company; there were cars, tracks, picks, shovels, drills, etc. I made out the pay sheets from my time book and gave them to Mr. Lawrence."

Q. 68: "Have you any memorandum as to the cost of the labor and incidentals in the drifting of the Crystal Springs tunnel?"

A. "Yes sir."

Q. 69: "What is that paper you have?"

A. "This paper is an exact copy of one furnished to Mr. Schussler at his request shortly after I left the work of drifting and bricking the Crystal Springs tunnel."

Q. 70: "Will you give us the exact cost of drifting the Crystal Springs tunnel?"

A. "The exact cost of drifting the Crystal Springs tunnel was $6,380.35. That is the money they gave me for it. There were 580 feet of drifting; that is according to the engineer's measurements of what I got, as near as I can get at it. Drift and shaft, at a cost of $11 per foot."

Q. 71: "What was the cost of labor per month?"

A. "That is the labor."

Q. 72: "Have you it for each month?"
A. "Yes sir."
Q. 73: "Just read that."
A.

June,	1887	$1,871.25
July,	1887	1,037.80
August,	1887	1,032.50
September,	1887	1,103.35
October,	1887	1,098.58
making a total of		$6,143.00

Powder and candles, $237. I did not find those. The company had them on the ground and supplied them. Mr. Schussler told me to keep account of everything I did there, so I did so. I did not pay for those."

The substance of Mr. Higgins' testimony above quoted is that he had 20 men working in the tunnel; that the men who did the drifting, the number of whom he does not give, received $2 a day and their board; that the rest of the men, who were men on the cars and roustabouts, the number of whom he does not give, received $40 a month and their board.

To the above total amount of wages, which Mr. Higgins says he paid for drifting 580 feet of tunnels, which actually have a total length of 554 feet (Schussler's Test. pp. 924-5), there must be added the cost of board of these laborers, the number of which he rounds off at 20 a day, including drifters, car-men and roustabouts. According to his very large pay-roll for June, 1887, he must have employed during this month considerably more than 20 men. However, taking 20 laborers, employed for only five months (and making no allowance for the extra number of men on his June pay-roll), we have, from June 1st to October 31st, a total of 22 weeks of board at $4 a week for each man, for a force of men employed, which makes the cost of board for this force of 20 men for 22 weeks, $1,760.

Mr. Higgins' wages as foreman during this time of at least five months, at $200 per month, was $1,000, to which must be added the cost of his board for 22 weeks, at $4 a week, or $88, which makes the cost of Mr. Higgins' services as foreman, during the five months while he watched the drifting of these tunnels, amount to $1,000 plus $88, or $1,088.

A recapitulation of the items of the original cost of drifting of these tunnels, taken from Mr. Higgins' own testimony, and not including anything for timbers, lagging, track, cars, tools, candles, etc., engineering, superintending, etc., expenses, is as follows:

Wages paid for labor for five months (see page 28 of defendants' testimony)	$6,143.00
Board of above men	1,760.00
Wages and board of Mr. Higgins	1,088.00
Total	$8,991.00

By dividing this total by the 580 feet of tunnels, which Mr. Higgins says he drifted, we have the cost per running foot of tunnel, based upon Mr. Higgins' testimony as $8,991 divided by 580 feet, or $15.50 per lineal foot, and not $11 per foot, as Mr. Higgins would indicate, by omitting the cost of the board of these men, as well as his own wages and board, and by assuming too great a total length for the tunnels drifted.

If the above total of $8,991 is divided not by 580 feet assumed by Mr. Higgins, but by 554 feet, which is the actual total length of these tunnels, we have the following result: $8,991 divided by 554 feet, or $16.22 per average lineal foot, which figure does not include any allowance for timbers, lagging, track, cars, tools, candles, etc., nor for engineering, superintending, etc., expenses.

TABLE XXVIII

SHOWING, IN MR. SCHUSSLER'S ESTIMATES OF COST OF DRIFTING AND TIMBERING THE TUNNELS, AT WHAT RATIO THE COST PER CUBIC FOOT OF MATERIALS EXCAVATED *DECREASES*, AS THE AREA, OR CROSS-SECTION OF THE RESPECTIVE TUNNEL *INCREASES*

Page of complainant's testimony or number of Exhibit	Name of Tunnel	Areas in *square feet*, equal to cubic feet per lineal foot	Mr. Schussler's estimate of cost for 1903–4, (exclusive of incidental, etc., expenses) of drifting and timbering, per lineal foot of tunnel	Estimated cost per cubic foot, excavated
769 775 789 863–4 1017	Pilarcitos No. 1 Pilarcitos No. 2 Lake Honda Bald Hill Lock's Creek No. 1	30.	$ 9.00	30 cents
Exhibit No. 52	Bernal Heights	±30.	9.00	±30 cents
996	Six-mile House	34.5	9.50	27.5 cents
925	Inlet tunnels Crystal Springs main dam	41.	10.00	24.4 cents
1025–6	Lock's Creek No. 2	45.	10.00	22.2 cents
890	Upper Crystal Springs outlet.	49.	10.50	21.4 cents
820 and Exhibit 39	San Andreas waste-weir	80.	14.00	17.5 cents
925	Crystal Springs main outlet tunnel	104.	16.80	16.15 cents

Mr. Schussler gives his estimate of cost of reproduction in 1903-4 of the drifting of the above outlet tunnels at the Crystal Springs main dam, as follows (Test. p. 924):

> "Drifting the two intake tunnels, one 54 feet in length and the other 170 feet in length, the two together having a total length of 224 feet, and having a diameter of 7 3-10 feet, or an area cut out of the solid rock of 41 square feet, cost $10 per lineal foot, $2,240.
>
> "Main outlet tunnel, drifting 330 feet in length, having an area of 104 square feet, cut out of the solid rock, at $16.80 per foot, $5,540. Total cost of these three tunnels, $7,780, inclusive of timbers and timbering, but exclusive of ten per cent for incidental, contingent, engineering, superintending expenses, track, cars, candles, tools, etc."

By dividing this estimate of $7,780 by the total length of the three tunnels, of 554 feet, we have an average cost estimate per foot of these tunnels, drifted and including timbers and timbering, but excluding the above incidental, etc., expenses of $7,780 divided by 554 feet, or $14.04, instead of the above average cost of $16.22 per average lineal foot, deduced from Mr. Higgins' testimony.

That Mr. Schussler, in his estimates for reproducing in 1903-04 tunnels of various sizes, regarding their cost of drifting and timbering has been conservative in these estimates, is shown in the following table (No. XXVIII), made up from extracts from his testimony and from complainant's exhibits.

The foregoing Table XXVIII shows that where the tunnels are small and cramped the cost of drifting and timbering the tunnels, reduced to the cubic foot of material excavated, is greater than in the larger tunnels, in which latter, owing to the greater and more convenient space given to the miners to work in, the cost per cubic foot of materials extracted decreases.

XVII.

Pilarcitos Main Dam.

The Testimony as to the Cost of This Structure Analyzed.

In Mr. Schussler's testimony on the subject of the cost of reconstruction of this structure (pp. 711 et. seq.) he details the character of materials used in the construction of the dam, and the method that would be employed in case of its reconstruction at the present time, of the same dimensions and proportions employed in its original construction. He took cognizance of the considerable increase in the cost of labor since the time, nearly four decades ago, when Mr. Emery, as contractor, attempted to carry out the construction of a portion of the original dam at a figure so low that he lost money on the job, and complainant, as shown by the testimony, was compelled to finish the dam by day's work (p. 2092).

Counsel for defendants, on page 330 of their brief, quoted from complainant's minute book an entry to the effect, that in February, 1865, a contract, for what was then intended to be the height of the Pilarcitos dam, was let to Mr. J. S. Emery at the rate of 36¾ cents per cubic yard, "satisfactory security to be given by him for the faithful performance of the work."

Counsel are silent as to whether, when Mr. Emery failed to complete the dam up to the then proposed height, he or his sureties were compelled to make good the deficiency. The contract price at which Mr. Emery took the job and on which he lost money is certainly no criterion either of the original cost or present cost of reproduction.

Nor can anything be deduced from the rate of wages which Mr. Emery says he paid to Chinamen who worked for him in the sixties.

In reference to the contractor's work on the original Pilarcitos dam, Mr. Schussler testifies (p. 2092):

X. Q. 2461: "How about the workmen?"

A. "The workmen belonged to the contractor at the beginning, but we watched very carefully that they put on only the best material and that it was put on the dam in the most thorough manner."

* * *

The Witness: "Well, he certainly took the contract entirely too low; he lost a great deal of money, and afterwards we had to finish that dam by day's work.

* * *

X. Q. 2463. "Who was the contractor?"

A. "A man from Oakland named Emery."

X. Q. 2464: "Do you know what his first name was?"

A. "I think it was Joseph Emery. He was a good man, but he had a bad job; he had undertaken a contract at too low a figure."

Again on page 2057 Mr. Schussler testifies as follows:

Q. 2259: "Do you know whether the contract for the construction for a portion of the dam was made at so much per cubic yard?"

A. "Yes, sir, it was made at either 38 or 40 cents a cubic yard. The contractor, being entirely

inexperienced in that kind of work, and no doubt assuming that it was something like a railroad embankment, and probably also assuming that the inspection would not be quite as rigid as what Mr. Lawrence and myself insisted upon; we insisted upon absolute perfect work, and the consequence was the man lost a great deal of money."

X. Q. 2260: "But your absolutely perfect work did not apply to the puddle core?"

A. Mr. Brown had charge of that; we were simply the assistants. Mr. Brown insisted upon the English method of softer puddle pit; that is all. That has all been rectified since we intended to increase the height of the dam for the purpose of a larger storage by making the addition to it and putting the cap on top and carrying the puddle pit from the old original dam on an incline into this cap, as shown on my diagram furnished.

X. Q. 2261: "Have you the contract?"

A. "No, I have no idea what has become of it."

X. Q. 2262: "Have you any record of the terms of it?"

A. "No sir, I have not."

X. Q. 2263: "Has the company?"

A. "May be. Possibly the Secretary may find something for you. My recollection is that it was 38 or 40 cents a cubic yard."

After describing the manner of constructing the original Pilarcitos dam, which included that portion constructed by Mr. Emery under his contract of February, 1865, and the remaining portion done by day's work by complainant, thus bringing the dam to its originally proposed height (Exhibit No. 30), Mr. Schussler says (p. 720):

"Later on, perhaps 6 or 8 years after the construction of the original Pilarcitos dam, it was concluded to raise this dam to a higher level and thus increase its water storage capacity. In order to be

able to raise the dam I added on the foot, that is, on the dry foot, a first-class embankment about 100 feet or a little over in thickness or in breadth, and by cutting benches into the rear slope of the original dam, and by making the layers the same as I have just described in the main embankment pitching also toward the main dam, we made a perfect splice of this new work with the old. That work was done so thoroughly that never has any sign of crackage or opening shown itself at the junction between the old and the new work, although the old work was from 6 to 8 years older than the new."

This large, subsequent addition to the original dam as it had been finished by complainant by day's work, 6 or 8 years previously, forms a large portion of the cubical contents of the present dam.

The work done by day's work, by and at the expense of complainant, on the present entire dam, as shown in the testimony, consists of the excavating and preparing of its entire foundation for the reception of the entire present dam, digging and timbering of the deep puddle trench across the entire valley, down to and into the bed rock, and keeping this pit free from water; construction, along the bottom of the valley portion of this puddle trench, of a concrete core; finishing of the upper portion of the original Pilarcitos dam, above the level where Mr. Emery quit the work, with its upward puddle-core extension along the entire length of the dam and deeply into the bed-rock slopes at each end of the dam; construction of the entire large addition to the original embankment (Exhibit 30), as well as the construction of the final large cap, consisting of bank and puddle clay covering or straddling the other respective tops of the original dam (as completed by complainant) and of the large down-stream addition to the original dam, as hereinbefore described; finishing of

the stone rip-rap from that part on the original lower contract portion, where Mr. Emery left off, to the top of the present dam.

This shows that complainant constructed a very large portion of the dam as it now stands, by day's work at its own expense, after Mr. Emery failed to perform his contract.

Complainant's Exhibit No. 30 gives a cross-section of the present Pilarcitos dam, and although it does not indicate the level at which Mr. Emery discontinued his contract work in the smaller original dam, it gives the outline to which the original dam was finished, partly by the contractor and partly by day's work of complainant, and it also gives the outline of the subsequent large addition made by complainant to the width or thickness of the dam as well as to the top of the same.

The impression given by the reference in defendants' brief to Mr. Emery's contract that the original cost of the entire dam, as it now stands, was only 36¾ cents per cubic yard is not in accord with the facts.

Mr. Emery says (p. 33):

> "The dam was commenced" (had been commenced) "when I took the contract; the foundation was" (had been) "dug out and prepared for the clay to be put in. The puddle pit was " (had been) "dug down some 20 feet below the surface, and it was" (had been) "blocked up so it would not cave. I commenced it then and built it within about 10 feet of the top."

So that from his own testimony it appears he neither commenced the work nor finished his contract.

Again he says (pp. 33-4):

Q. 19: "What were you to be paid for doing that work?"

A. "36¾ cents per cubic yard, I believe."

* * *

Q. 24: "What sort of labor did you use upon that work?"

A. "First I had white men, and they struck for some cause or other—I have forgotten what—then I hired Chinamen. A short time after I commenced I took Chinamen and they did the shovelling and picking and one thing and another. I had some white men with me, but not many."

Q. 25: "How long were the white men with you before they struck?"

A. "I do not remember; not a great while. It was not up very high."

Q. 26: "Not very long?"

A. "No."

Q. 27: "The balance of the time you used the Chinamen?"

A. "Yes, mostly Chinamen. I had a few superintendents who were with me, and some others, but mostly Chinamen."

Q. 28: "The foremen and superintendents were white men?"

A. "Yes sir."

Q. 29: "About how many Chinamen did you employ on that work?"

A. "I think from 200 to 300."

Q. 30: "What wages did you pay the men?"

A. "I do not remember. I think I paid them one dollar a day and they furnished their own provisions, but I have forgotten."

Q. 51: "You think it was about one dollar a day and they boarded themselves?"

A. "To the best of my recollection. I would not want to say positively, because I have no data to go by now, only from memory."

Q. 32: "Was it over a dollar and a quarter a day?"

A. "No, I do not think it was."

Q. 33: "What sort of work did the Chinamen do?"

A. "They filled the carts and they broke down the banks. I believe some of them worked on the dam, spreading the dirt. I do not know."

Q. 34: "Was their work satisfactory?"

A. "Oh, yes, we did not have any complaint."

Q. 35: "Would a Chinaman do as much work a day as a white man on that character of work?"

A. "Oh, yes, I guess they did. They worked very well."

Q. 37: "How many hours constituted a day's work when you built the Pilarcitos dam in 1865?"

A. "I think about 10 hours' work."

Regarding the difficulty of obtaining the proper materials for the puddle trench, as well as for the embankment of the dam, insisted upon by the engineers of complainant, Mr. Emery says (p. 36):

Q. 38: "What methods did you use in the excavation of that Pilarcitos dam, and the building of the dam itself? Just describe it as fully as you can, and as you best remember it? Where you got the clay, how you used it, and so forth; give us a description in detail?"

A. "It was very difficult to find the proper material there; the bedrock would come up pretty high. There was very little clay around there. We got the very best material we could get and put it in. Some we hauled a long distance; we went away up the road and hauled it half a mile. Some blue clay I found in the valley, in the bed of the reservoir; that was used in the puddle pit."

Further on in his testimony, Mr. Emery, speaking from recollection, after nearly forty years, thinks that he used some yellow clay in the lower portion of the puddle pit. In this he is mistaken, as only the very best of blue clay was allowed to go into this important

portion of the Pilarcitos dam, as well as in the San Andres and Upper Crystal Springs dams, as is shown in Mr. Schussler's testimony.

It is probable therefore that Mr. Emery refers to the yellow clay, which was obtained in many pits after removing the top soil, and which was largely used in the construction of the main embankment, both by Contractor Emery and afterwards by complainant.

In the original estimate of Mr. Schussler regarding the quantity of top soil removed from the base of the Pilarcitos dam, as well as of the San Andreas and Upper Crystal Springs dam, an error in the total number of cubic yards of both cut and fill had crept into the same.

Mr. Schussler discovered this error after he had given his direct testimony regarding these dams, and, as shown in his testimony, he notified complainant's attorney of his discovery and of his desire to correct the error. He says (Test. p. 2040):

> A. "I notified Mr. Kellogg" (complainant's attorney) "several months ago of this fact and he told me I should bring it out in court when the proper time came."

The statements in defendants' brief (p. 345) that Mr. Schussler "afterwards admitted considerable errors in his calculations," and again (p. 348) that "Mr. Schussler admitted an error of 16,000 cubic yards in his calculation of removal of top soil and embankment work at Pilarcitos dam," are apt to give the impression that counsel for defendants had discovered an error in Mr. Schussler's figures and had forced the admission from him which is not the fact.

Regarding the materials specified and required for the dam, Mr. Schussler says (Test. pp. 712 et seq.):

"The very greatest difficulty we encountered was the finding of the proper material for the building of the dam. There were no continuous large clay pits where large masses of clay, suitable for the construction of this dam could be got on a large scale. We would open a pit by prospect holes and find, after perhaps 3 or 4 weeks or more, the clay contents of that pit were exhausted. Meanwhile, we had prospectors constantly at work within a reasonable distance from the dam, to look out for more clay. As we needed a great many hundred thousands of yards of this choice material, it was necessary that we keep constantly on the lookout ahead of time. The valley of the Pilarcitos reservoir was generally covered with a thick underbrush and some growth of timber —mostly small oak, but principally a thick, dense brush. The surface soil ran from a foot and a half to 2 feet of loamy sandy top soil. Below that a very good clay material, fit for first-class banks, if properly worked, was found. The pits ran from 7 or 8 feet in depth, and in some cases 10 and 12 feet in depth, but owing to the fact that this clay material was not locally found, but scattered in various pits, we had to open a great many pits for the purpose of gradually getting all of the large amount of material that was required for the building of the dam. As regards the blue clay that we used for the puddle pit, for the center core, great difficulty was found in procuring it because the blue clay was located generally at the bottom of the ordinary good bank clay, as we called it, and could not be got at until we had removed not only the brush, but the top soil and the bank clay. We usually tried to combine, for the sake of economy, the excavation of these materials in such a manner that if we had exposed in the bottom of a bank-clay pit a good deposit of stiff blue clay for puddle-pit purposes we would leave that until necessary for the placing of this stiff blue clay in the center puddle core, as we call it. The method of procedure of getting at and opening

these clay pits was about as follows: I wish to state, by the way, that we did not allow any clay pits to be opened nearer than about 200 yards from the dam on account of not inviting any leakage into any subsoil and perhaps this water might be passing into the subsoil of the dam. The pits were scattered in distances from about 200 yards to about 500 yards from the dam; some of the stiff blue puddle-clay pits were even further than that, but the bulk of the blue puddle-clay was found in some of the deep bank clay pits as I have described. The average distance of these pits from the center of the dam ran in the neighborhood of 1,000 feet—between 900 and 1,000, so that I have called it an average distance, taking the various pits together, in the neighborhood of 300 yards, that is, it was necessary to haul the material fully 300 yards to bring it to the dam, and, of course, that was up hill, because, as the dam grew to greater height or was raised to greater height it required the construction of new roads, which, with a gradual incline, led from the pits up to "the top of the dam at the respective times."

He then described at length the most economical manner of removing the top soil from the prospective clay pits, by using plows and scrapers, wherever possible in the flats, and picks, shovels and wheelbarrows on side hills, where the ground is less accessible.

Mr. Emery says (Test. p. 30), and this is quoted in defendants' brief (page 331), that he did not use any plows in the execution of his contract on the Pilarcitos dam, because: "it was all hillside."

As will be seen from Mr. Schussler's description of the method of obtaining and hauling the clay from the pits to the dam, a large portion of the clay came from pits located in the bottom of the valley where the use of plows and scrapers forms the most economical method for removing the top soil.

In Mr. Schussler's estimate of the cost of reproduction in 1903-4, of the present Pilarcitos dam, which, besides the portion constructed by complainant by day's work, also includes the portion done by Mr. Emery under his contract, he bases his estimates of present cost of construction upon the more economical use of the plows and scrapers wherever they can be used to advantage in the flats, while, where their use is not practical or economical on hillside work, his estimate is based on the use of picks, shovels and wheelbarrows.

Mr. Emery's testimony regarding the difficulty he experienced in obtaining the required quality and quantity of puddle and bank material, has been already quoted. He practically agrees with what Mr. Schussler says as to the difficulty of obtaining the material and the distances some of it had to be hauled from the pits to the dam.

To produce the impression that this Pilarcitos dam was defective in construction, counsel for defendants in their brief (p. 355) quote from the testimony of Mr. Lawrence, given, not in this case, but in the course of some litigation pending in 1879 in San Mateo County to the effect that the capacity of the reservoir could not be increased because it was 94 feet high and he did not think it would be safe to build it higher, for the reason that the foundation was "not properly constructed" to admit of a greater height.

Mr. Lawrence gave as his reason that Mr. Calvin Brown, the engineer then in charge of the work in building the puddle pit, when he got the dam up about 70 feet, left one night and when he went up there the next morning the dam had gone down about 10 feet.

Commenting on this testimony of Mr. Lawrence, counsel for defendants, in their brief (p. 355) say:

> "Mr. Lawrence's statements as to settling of dam are corroborated by the following extracts from the minutes, book B, page 498, May 28, 1874:
>
> " 'The President informed the Board, that there was attention required at the Pilarcitos dam. He then called in Mr. Schussler and Mr. Lawrence, who gave the Board a full explanation of the cause, etc., and also how it was proposed to remedy the trouble. After full consultation the work was ordered to be done at once. The President requested such members of the Board as could go down and see the dam, to do so next day.' "

Reference to the testimony will show that counsel are entirely mistaken, because the matter referred to in the minutes of the meeting of the Board of Directors had no connection directly or indirectly with the settling of the dam during construction, spoken of by Mr. Lawrence in his testimony. The dam was constructed during the years 1865, 1866, 1867, and 1868 (see Reynolds' testimony, Table II of this appendix). The "settling" spoken of by Mr. Lawrence occurred while the dam was being constructed. The meeting of the Board of Directors, cited by defendants' counsel, was held in 1874, at least six years after the dam was finished. Mr. Schussler was examined by defendants' counsel at considerable length on the subjects both of the "settling" referred to by Mr. Lawrence and the incident to which the minutes of the meeting in 1874 relate. (Test. pp. 2047, 2048, 2050-1, 2062-3.) He showed in the first place that Mr. Lawrence was mistaken as to the extent of the settling, which Mr. Schussler speaking from his own knowledge knew to be only at the top of the dam and not at its foundation and only about four feet instead of ten (Test. pp. 2047-8), and secondly that the two incidents, namely the settling of the dam some time between 1866 and 1868, and the work done in 1874 bore no relation whatever to each other.

The work done in 1874, which Mr. Schussler describes in great detail (Test. pp. 2062-3) was rendered necessary, not by the settling of the top of the dam about 6 to 8 years previously, but by seepage from a spring which developed or made its appearance through the bed-rock at the east end of the dam in 1874, about 8 years after the completion of the dam. Mr. Schussler went on and explained in detail the steps taken to remedy this. That it was completely remedied is shown by the fact that the dam has stood intact for forty years since, notwithstanding the terrific strains to which it was subjected by the earthquake of 1868 and the still greater shock of that in 1906. Counsel for defendants, having learned the actual facts through their examination of Mr. Schussler, it is difficult to understand how they could have been led into the error of quoting the minutes of the meeting of 1874 as "corroboration" of Mr. Lawrence's testimony on a subject with which the incident referred to at that meeting had no connection whatever.

The Cost of Reproduction of This Dam.

As previously stated in this brief, Mr. Emery, in his testimony, does not state the number of cubic yards of bank material and puddle clay which he placed in the dam, during the time that he worked as contractor on the Pilarcitos main dam in 1865-6; nor how much money he or his bondsmen lost before abandoning his contract at the figure of 36 3-4 cents per cubic yard.

From his testimony we learn that the puddle cut and foundation of the dam was prepared for him by and at the expense of complainant; that he did not complete the original dam up to the height which he had contracted for; that the best materials obtainable were used, and were difficult to obtain, and that they had to be gathered from scattered pits, some of which

were located about half a mile from the dam; that for most of his work he employed Chinamen, ranging from 200 to 300 in number; that he considered them as good workers as white men; that they worked ten hours a day; that, to the best of his recollection, they received one dollar a day and boarded themselves.

At the rate of pay of one dollar a day of ten hours, these Chinese, constituting the large bulk of Mr. Emery's force, received 10 cents per hour.

Mr. Schussler's estimate of what it would cost in 1903-04 to reconstruct the entire present Pilarcitos main dam is based on the necessity at the present time of employing white laborers at $2.50 per day of 8 hours, or 31 1-4 cents per hour, or 3 times the rate which Mr. Emery paid to his Chinamen, and at which rate, even, he lost money on the contract and failed to complete it.

XVIII.

CRYSTAL SPRINGS CONCRETE MAIN DAM.

What Is Shown by the Testimony as to the Cost of This Structure.

A.

The Thickness of the Dam Is Not Excessive.

Counsel for defendants, in their brief (pp. 111-112) criticize the Crystal Springs dam on account of what they call its excessive thickness. They argue that because the present height of the dam is 145 feet while its base is sufficient to allow of an ultimate increase in height to 175 feet, this fact shows an unnecessary expenditure which they arbitrarily estimate as amounting to at least $500,000, and in support of this argu-

ment they refer to three exhibits (Nos. 88, 89 and 90) introduced by Mr. Dockweiler, purporting to show comparisons with other dams in other parts of the United States and elsewhere.

Counsel for defendants do not make any deduction in their estimate of values for this socalled excessive expenditure, but they point to the fact that they do not make such deduction as argument or illustration that their other computations of value are conservative.

Defendants' exhibit No. 90, which is used in support of their argument, purports to show the profiles or cross-sections of eight finished stone masonry dams and of one ideal dam (not constructed) compared with the profile or cross-section of the Crystal Springs dam in its present unfinished state.

For the purpose of showing the unfairness of the comparison, and the fallacy of argument based thereon two diagrams have been prepared and are here inserted.

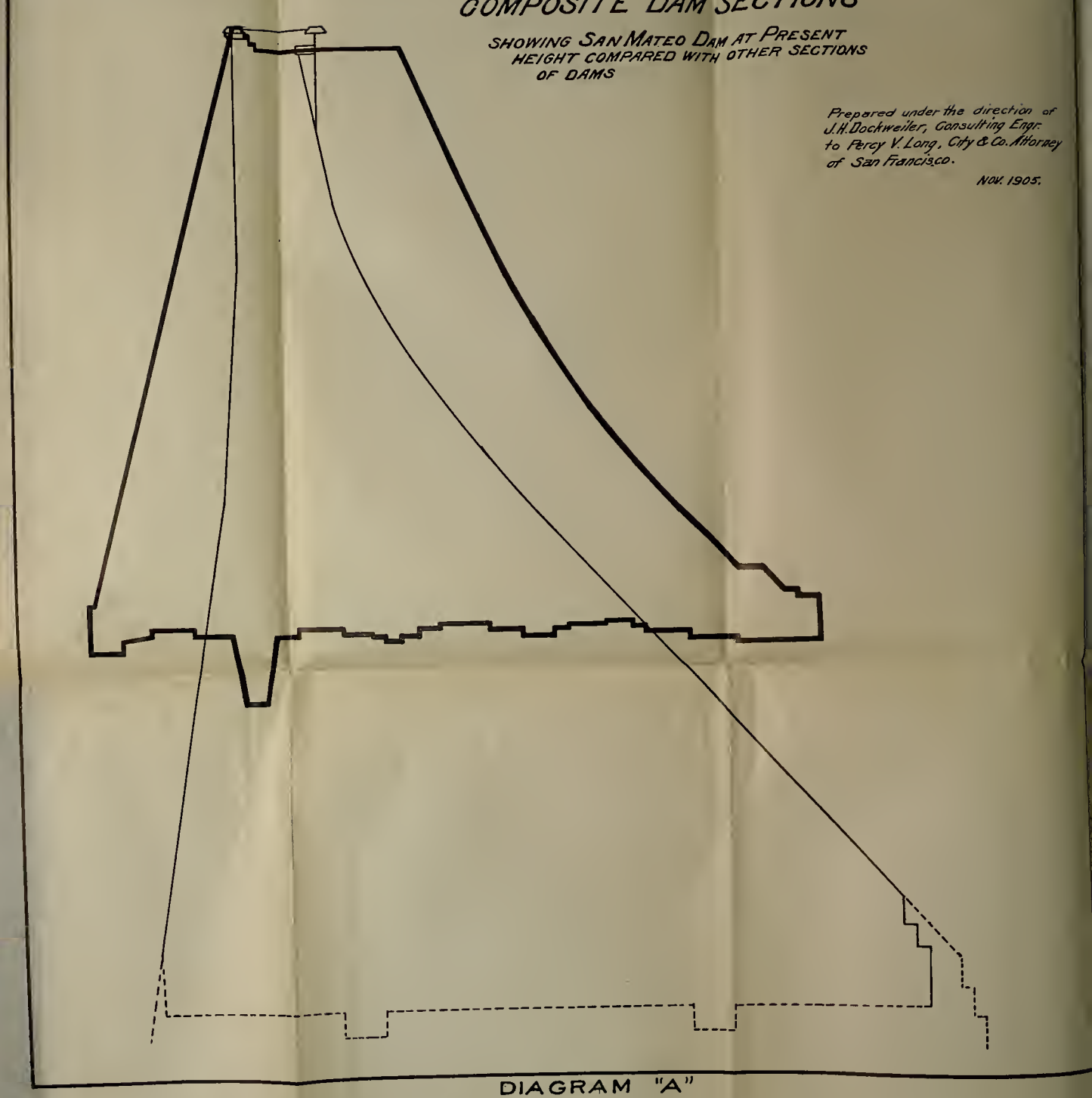
COMPOSITE DAM SECTIONS
SHOWING SAN MATEO DAM AT PRESENT HEIGHT COMPARED WITH OTHER SECTIONS OF DAMS
Prepared under the direction of J.H. Dockweiler, Consulting Engr. to Percy V. Long, City & Co. Attorney of San Francisco.
NOV. 1905.

DIAGRAM "A"

Taken from Defendant's exhibit No. 90 in which is shown its method of ascertaining—(as asserted on pages 112-113 of its brief,)—that the cross-section of the **Crystal Springs Dam** (heavy line) exceeds the cross-section of the **New Croton Dam** (light line) near New York City, by 84 per cent.

Defendant obtains this result by placing the present broad top of the **unfinished** Crystal Springs Dam, on the same level with the top of the **finished** New Croton Dam, and then calls the area by which the former overlaps the latter: **the excess area of 84 per cent.**

In Diagram "B," the correct method for proper and fair comparison of the respective areas of the two Dams is shown.

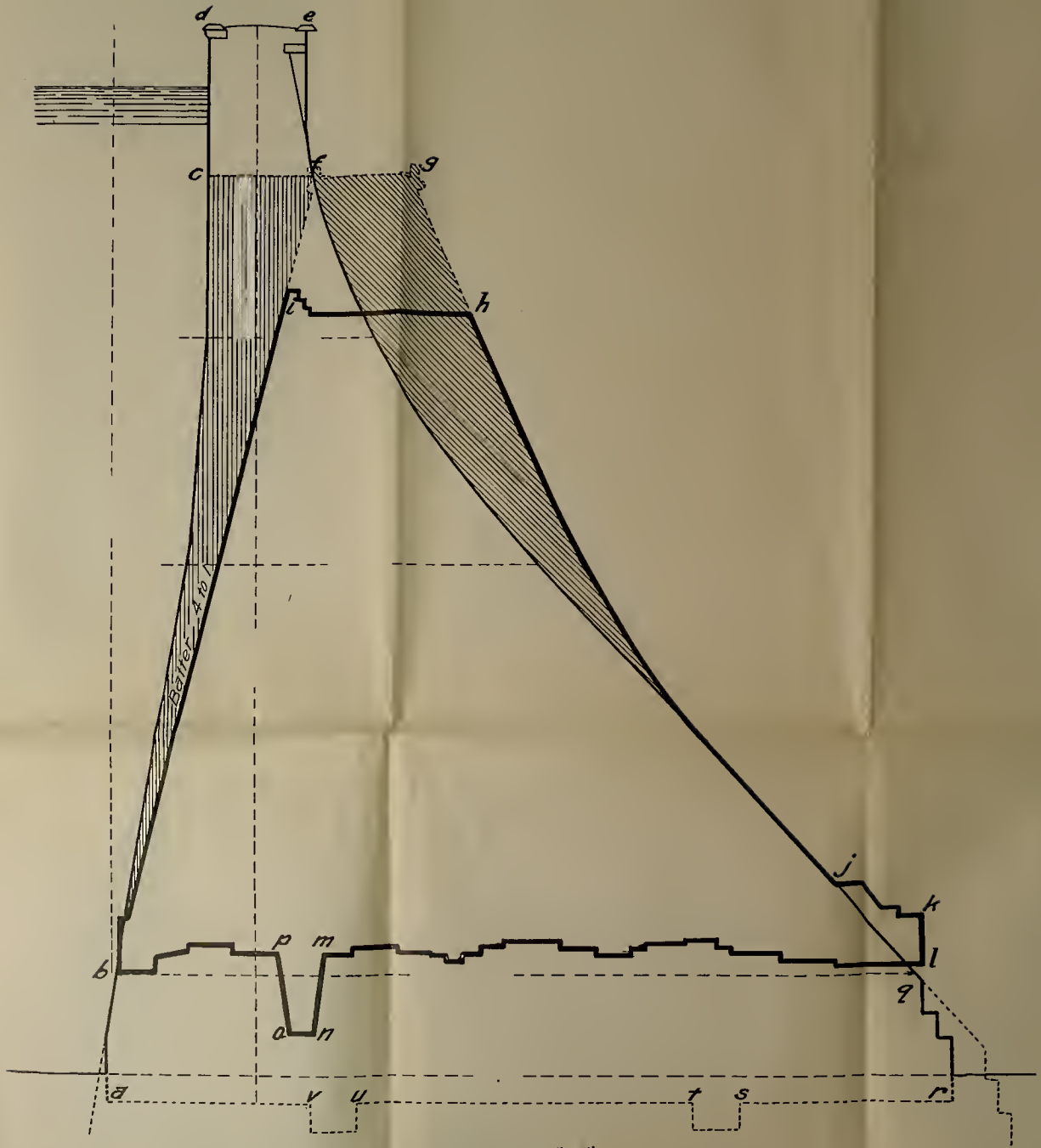

DIAGRAM "B"

In this diagram the cross-section of the **Crystal Springs Dam** in its present **unfinished state;** (outlined by letters ***b-i-h-j-k-l-m-n-o-p-b***), is placed in its proper position, for the purpose of a fair comparison between the two respective areas of the **Crystal Springs Dam,** and the **Croton Dam,** so that the base of the former is at a level, where the thickness of the ***base*** of the former corresponds with **thickness** of the latter.

Diagram "B" also shows by letters ***i-f-g-h:*** the additional height of **30 feet,** for which the present **Crystal Springs Dam** is designed, thus making its then total height: **175 feet** instead of **its present unfinished height** of **145 feet.** (As shown in complainant's testimony, (page 2204), this height may eventually be still further increased to **198 feet,** being an addition to the **present unfinished height,** of: **53 feet,** without increasing the thickness of the present dam.)

The **New Croton Dam,** having a steeper water face, than the **Crystal Springs Dam,** shows up to the contemplated 175 feet height of the latter dam, (**by vertical shading**), an apparent excess area over the latter, which excess area is a little more than counterbalanced by the **diagonally shaded** portion of the **175 feet** Crystal Springs Dam.

In short,—the two cross sections, thus **properly** and **fairly** placed in relation to each other, show, that the cross-section or area of the **Crystal Springs Dam** finished to 175 feet height,—exceeds that of the finished **New Croton Dam,** by less than 5 per cent,—instead of **the 84 per cent,** shown by Defendant on pages 112-113 of its brief, which is the result of the unfair method of comparison, adopted by it as shown in **diagram "A"** taken from Defendant's exhibit No. 90.

Diagram A gives a copy of that portion of defendant's exhibit No. 90, which shows the method used in the exhibit to compare the present unfinished Crystal Springs dam with the finished and completed new Croton dam. By placing the tops of these two structures in their present condition, instead of their bases, at the same level, Mr. Dockweiler or whoever prepared this exhibit for defendants, attempts to show that the cross-section of the former dam exceeds that of the latter by 84 per cent.

Diagram B shows the only fair and proper manner by which the areas or cross-sections of the two structures can be and should be compared, which is, by placing the base of the Crystal Springs dam at the exact level where the thickness of the Croton, or of any of the other high dams mentioned by defendants, equals the breadth of the base of the Crystal Springs dam.

When this is done as illustrated on Diagram B, the result is that instead of an excess area of 84 per cent as claimed by defendants for the present Crystal Springs dam, over the cross section of the new Croton dam, the excess area is actually less than five per cent.

Whenever the Crystal Springs dam has been finished to its originally contemplated height of 175 feet or to the now contemplated future maximum height of 198 feet, or 53 feet above its present unfinished top, the above excess area of less than five per cent over that of the new Croton dam will be still further reduced.

Either the originally contemplated increase of 30 feet or the increase now contemplated of 53 feet in height can and will be done on the present unfinished top of the dam, and without any addition to its present

base or any part of its thickness below the present top, and without any impairment of its safety.

Mr. Schussler's testimony regarding the contemplated future additions of 30 or 53 feet to the present height of the dam is shown on pages 2203-5 of complainant's testimony.

However, we presume the Court may take judicial cognizance of the terrific shock to which this structure was subjected by the earthquake of April 18th, 1906, and the Judge of the Court having himself inspected this dam in the year 1908 must know how it withstood the force of that shock. It would seem, therefore, that even if the base were greater than what may be found in dams differently situated, there would be sufficient justification for the extra width, even though no additional height had ever been contemplated above the originally proposed addition of 30 feet.

B.

The Testimony as to the Cost of the Crystal Springs Dam.

Counsel for defendants in their brief (p. 306) quote from Mr. Schuyler who in answer to a question on cross examination as to whether "in his opinion" the Crystal Springs Lower Dam would cost the same to reconstruct in 1903-4 as at the time it was built replied:

"I do not think there would be any material difference in that class of work" (p. 5553). The most cursory examination of Mr. Schuyler's whole testimony shows that Mr. Schuyler disclaimed any exact knowledge as to the cost of labor in California at the time this work was done. His answer to the question was merely an offhand opinion given on the spur of the moment, in the most general terms and without

any detailed information of necessary data on which to base it.

Mr. Schussler's testimony (pp. 2188 and 2681 and elsewhere) gives precise and detailed figures showing that in the item of labor alone, the increase in wages of common labor from $2 a day to $2.50 a day and the shortening of the hours of labor from ten hours to eight hours a day made an increase in the wage rate of fifty per cent.

Mr. Schussler's Estimates of Cost of Reconstruction of the Main Crystal Springs Dam.

Mr. Schussler, on pages 901 to 913 of his testimony, gives a detailed description of the materials used and the manner in which they were obtained, and on pages 913 to 939 he gives detailed estimates of the accessories to this dam, namely: preparing the foundation, concrete factory, outlet shaft, tunnels, pipes, gates, etc., Howard Cut, and extra work not included in the above.

The reproduction estimates for these accessories in detail are as follows (pp. 913-916):

Excavating and repairing foundation for dam		$53,100.
Add 10% for incidental, etc., expenses		5,310.
Total		$58,410.
or, in round figures		$58,000.
(Pages 916 to 917:) Concrete factory, trestle, sand-bin, platform, engines, etc., additional mixers, warehouses, etc.	$113,700.	
Add 10% for incidental, etc., expenses	11,370.	
Total	$125,070.	
or, in round figures		$125,000.

(P. 931) Outlet shaft, tunnels, pipes, gates, etc.	$117,460.	
Add 10% for incidentals, etc., expenses	11,746.	
Total	$129,206.	
or, in round figures		$129,000.
(pp. 932-3) Howard Cut	$116,400.	
Add 10% for incidental, etc., expenses	11,644.	
Total	$128,084.	
or, in round figures		$128,000.
Extra Work:		
(pp. 935-9) Removing pipe (44-inch) from side of reservoir	$ 16,800.	
Building flume	25,000.	
Clearing reservoir site, etc.	25,000.	
Building roads and fences	35,000.	
Concrete apron at foot of dam	3,500.	
Rip-rap	4,900.	
Total	$110,200.	
Add 10% for incidental, etc., expenses	11,020.	
Total	$121,220.	
or, in round figures		$121,000.

Thereafter, on pages 940 et seq., after explaining exhibits furnished in connection with this dam, Mr. Schussler gives in great detail, his estimates of cost of constructing the main body of the Crystal Springs dam, from which the following data and figures are extracted:

"The Crystal Springs main dam proper which, as I said before, contains 157,200 cubic yards of concrete. This body of concrete required 194,559 barrels of cement and 389,100 barrels of sand. 157,200 cubic yards of concrete are equal to 4,244,400 cubic feet. Dividing 4,244,400 cubic feet by the number of barrels of cement used, 194,550 barrels of cement, we have 21.81 cubic feet of concrete measured in place for each barrel of cement used. This amount of cement was put into the dam in the following periods as to years:

1887	28,962 barrels;
1888	128,090 barrels;
1890	37,499 barrels.
Total	194,551 barrels,

which, for round figuring, I have called 194,550 barrels."

He then gives the cost of labor in different groups as follows:

First Group of Labor (*p.* 945).

"Cost of quarrying, selecting, loading into wagons, hauling to and delivering on the top of the crusher platform of the dam; the rock is there re-selected and its costs, per cubic yard of concrete measured in place ..... $1.42.

Wages per day of eight hours including board:

Foreman	$4.80 per day;
Drillers at quarry	3.20 per day;
Labor selecting rock, handling it in quarry and loading into wagons	2.50 per day;
Two-horse team, inclusive of driver	5.00 per day;
Blacksmith's helper	3.20 per day.
Blacksmith	4.00 per day;

Second Group of Labor (*p.* 946).

"The second group of work is composed of work on concrete platform, including the feeding of the crushers, crushing the rock and washing the same but not including the mixing. This (group) cost per cubic yard of concrete measured in place ..... $0.41."

Wages per eight-hour day including board:

Foreman	$4.80 per day;
Engineers running machinery	4.80 per day;
Firemen	3.20 per day;
Laborers, crusher feeders, etc.	2.50 per day;
Crusher oiler	3.20 per day;
Laborers attending to washers	2.50 per day.

Third Group of Labor (*p.* 946).

"The next (third) group is the mixing of the concrete, transporting it to the chutes and dumping it through the chutes. This works costs, per cubic yard measured in place ..... $0.55."

Wages per eight-hour day including board:

Sand-bin men	$2.50 per day;
Sand-car men	2.50 per day;
Cement-car men	2.50 per day;
Cement-platform men	2.50 per day;
Barrel-openers, some men and some boys, averaging	2.00 per day;
Mixer-feeding men	2.50 per day;
Brakemen at	
Mixers	3.20 per day;
Car-men	2.50 per day;
Switchmen on the track (boys)	1.60 per day;
Chute-men (at top)	2.50 per day.

Fourth Group of Labor (*p.* 947).

"Making concrete blocks on dam, cost, per cubic yard measured in place ..... $1.48."

Wages per eight-hour day including board:

Foreman	$4.80 per day;

Laborers, loading concrete into wheelbarrows at bottom of chutes ..... 2.50 per day;
Laborers, wheeling concrete to the blocks on the dam ..... 2.50 per day;
Laborers, shoveling and spreading concrete in thin layers .. 2.50 per day;
Laborers, ramming concrete in thin layers ..... 2.50 per day;
Laborers, picking blocks and cleaning pits, etc. ..... 2.50 per day;
Laborers, sprinkling top of dam. 2.50 per day;
Carpenters (building frames for blocks) ..... 4.00 per day;
Carpenters' helpers ..... 3.20 per day.

Fifth Group of Labor (*p.* 948).

"Extra labor in connection with the construction of the dam, not included in the above cost, per cubic yard..... $0.30."
Laborers cleaning front of dam, getting it ready for the plastering .....$2.50 per day;
Water boys ..... 1.45 per day;
Blacksmith ..... 4.00 per day;
Blacksmith's helper ..... 3.20 per day;
Watchmen (work 12 hours) .... 3.00 per day;
Stablemen ..... 2.50 per day;
Warehouse-men ..... 2.50 per day;
Plasterers on front of the dam.. 6.80 per day;
Laborers attending them ..... 2.50 per day;

The cost of extra labor of $0.30 per cubic yard of concrete in place on dam also includes:

"Overtime on dam, cleaning engines, fixing crushers, putting on toggles, dies—getting ready for the next morning's start—overtime work, cleaning new pits on the dam, and the men working overtime in the concrete pits."

Recapitulation.

Mr. Schussler recapitulates the above five (5) groups, as to the cost in 1903-4, per cubic yard of concrete in place in the dam as follows:

"A. (First group.) Quarrying, selecting and handling and hauling rock, per cubic yard	$1.42
"B. (Second group.) Concrete platform, feeding crushers, and washing, exclusive of mixing, per cubic yard	0.41
"C. (Third group.) Mixing and transporting and dumping through chutes, per cubic yard	0.55
"D. (Fourth group.) Loading, wheeling and making large concrete blocks on dam, per cubic yard	1.48
"E. (Fifth group.) Extra labor on above work, not enumerated in former groups, per cubic yard	0.30
Total	$ 4.16

per cubic yard, measured in the dam, representing the labor, inclusive of all the work in the quarry, connected with the construction of this dam, outside of the materials and the furnishing of the materials."

Materials.

Outside of the rock (the cost of which is included in the above item of labor of quarrying, selecting, handling and hauling the same, of $1.42 per cubic yard of concrete),—the materials used are cement and sand. Mr. Schussler says, in regard to these materials: (p. 950)

"The materials—being cement and sand—used in the construction of the Crystal Springs dam, as before stated, amounted to 194,550 barrels of cement

and 389,100 barrels of sand. These are the materials used in the dam proper in the construction of 157,200 cubic yards of concrete in the main dam."

The respective cost for 1903-4 of these materials, per cubic yard of concrete in the dam, Mr. Schussler, gives as follows (pp. 951 and 952):

"the cost of the cement per cubic yard" (of concrete) "measured in place, exclusive of incidentals 3.91
"the cost of the sand needed and used for each cubic yard of concrete measured in place on the dam $1.36 9-10; or, in round figures ..... $1.37."

The above costs of cement and sand, he itemizes as follows (pp. 950-2):

a. Cement.

Cost in San Francisco .....$2.65 per barrel;
Handling from ship to depot in San Francisco and staking in San Mateo warehouse ..... 0.10 per barrel;
Freight from San Francisco to San Mateo ..... 0.10 per barrel;
Hauling from San Mateo warehouse to Crystal Springs dam.. 0.31 per barrel;

Total cost per barrel of cement delivered at dam $3.16

194,550 barrels of cement delivered at dam, at $3.16, equals $614,778. This sum, divided by the number of cubic yards of concrete in the main dam, of 157,200, is $614,778, divided by 157,200 barrels, or $3.91 for cement for each yard of concrete measured in place in the dam.

b. Sand.

Sand delivered in bags at San Mateo wharf, per cubic yard $1.60

Hauling from San Mateo wharf to top of Crystal Springs dam and there placed into the sand-bins, per cubic yard 2.50

Total cost per cubic yard of sand delivered into the sand-bins $4.10

Total amount of sand, used in construction of main dam 52,500 cubic yards of sand, which, at $4.10 per cubic yard, equals $215,250.

By dividing the $215,250 by 157,200 cubic yards of concrete in the main dam, we have $1.37 as the cost of sand per cubic yard of concrete.

(p. 952.) "Recapitulation of the cost of concrete in place in Crystal Springs dam, per cubic yard of concrete, and exclusive of 10% for contingent and incidental expenses, engineering, superintending, etc.:

Cement, per cubic yard of concrete so measured	$ 3.91
Sand, per cubic yard	1.37
Labor, per cubic yard	4.16
Total, per cubic yard	$ 9.44
Adding to this 10% for contingent, incidental and other expenses	$ 0.94

we have a cost per cubic yard in place, exclusive of interest during construction. $10.38

In the above 10% for incidental and contingent expenses and so forth are included engineering, superintending, draughting, surveying, reservoir and dam site; and contingent expenses, such as powder for quarrying, drills, steel, all tools for quarry and dam, such as picks, shovels, rammers, wheel-barrows, water-tanks, water-pipes, boilers and pumps, building and fuel for same, system of sprinkling pipes and hose, blacksmith outfit and materials during the entire three years of construction, rubber boots, roads and bridges to both quarries, nails and many

hundreds of thousands of feet of lumber required in making frames and concrete boxes on the dam and also for covering concrete, repairs to machinery, accidents, medical service, etc.

157,200 cubic yards of concrete at $10.38 per cubic yard $1,631,736

or, in round figures, $1,631,000, inclusive of 10% for above detailed incidental, contingent and other expenses.

Recapitulation.

Recapitulation of the entire Crystal Springs dam, complete with all the appurtenances heretofore detailed such as the preparing of the foundation, the concrete factory, the outlet shafts, tunnels, pipe, etc., the Howard Cut and the extra work and construction of the main dam:

Preparing foundation	$ 58,000.
Concrete factory	125,000.
Outlet shaft, tunnels, pipes, gates, etc.	129,000.
Howard Cut	128,000.
Extra work, not included in above....	121,000.
Construction of main dam.....	1,631,000.
Total, inclusive of 10% for incidentals, contingencies, etc., but not including interest during construction	$2,192,000."

The foregoing shows that Mr. Schussler's estimates were not a matter of mere guesswork or opinion but based on precise details as to the materials and labor used in the original construction and necessary to be used if the works were to be reproduced in 1903-04.

XIX.

Sunol Filter Galleries.

What Is Shown by the Testimony as to the Cost of the Work.

Counsel for defendants, in commenting on Mr. Schussler's estimates of the cost of this work, show that he estimates the item of excavation of the 190,000 cubic yards required at $73,480, or about 35 cents a cubic yard (Defendants' brief, p. 289). They argue that this is grossly excessive by quoting what purports to be an entry in Complainant's minutes showing that a contract was let for this excavation at the time the work was done at a rate of 22½ cents a cubic yard.

The answer to this is: First, Mr. Schussler's estimate of $73,480 included 10% for engineering, incidental expenses; and second, it was shown in the testimony that although the contractor undertook to do the work by plow and scraper at the rate of 22½ cents a cubic yard, he "found he was losing money on the job" and did not complete, and therefore complainant hired his teams and did the work by the day (Test. p. 2857). The contract therefore is no evidence whatever, either of cost or present value.

Mr. Schussler gave detailed estimates of the cost of this excavation (pp. 1091-2), and also showed the character of the work to be done and that the cost of the work under the conditions of labor, etc., in 1903-04 would be $66,800 for the 190,000 cubic yards, showing by simple calculation a cost of 35 cents a yard without any allowance for incidental, engineering, etc., expenses, and it must be remembered that in the four years between 1899-1900 and 1903-4 there had been a

considerable increase in the cost of labor, as shown by the testimony in preceding subdivisions of this brief.

In the same portion of their brief counsel for defendants compare Mr. Schussler's total estimate of present cost of reconstruction of the Sunol aqueduct and filter beds, of $872,000, with what Mr. Reynolds found charged to these specific structures in complainant's accounts, namely $714,541.37, an excess over those cost charges of $157,458.63. They argue that, as the works were constructed three to five years previously, "any increase in cost of labor could not account for such an enormous difference."

Mr. Schussler's total estimate of $872,000 includes 10% for engineering, etc. If 10% be added to Mr. Reynolds' direct cost charges the difference between the two estimates will be found to be only 11 per cent, and the testimony previously quoted shows that the cost of labor per hour alone, which forms the larger part of the cost of this work, has increased over fifty per cent since the year 1901, without saying anything of the increased cost of materials.

XX.

The City Pipe System.

Answer to Criticisms of Counsel on Mr. Schussler's Estimates of This Portion of the Works.

In Table No. 9 and on pages 264 et seq. of their brief, counsel for defendants compare the estimates of Mr. Schussler with those of Mr. Schuyler, Mr. Adams and Mr. Grunsky, Mr. Dockweiler and Mr. Fitzgerald, and argue from the comparison that Mr. Schussler's estimates are "exaggerated, unreasonable and unwarranted" (Brief, p. 265). Mr. Schuyler and Mr. Adams

were engineers called by complainant, Messrs. Grunsky, Dockweiler and Fitzgerald were witnesses for defendants.

Mr. Schussler, who for nearly forty years had charge of the engineering department of complainant's works, and was familiar with every detail of its construction, with the quality and cost of materials and the cost and performance of the required labor in all its phases, and was familiar with the difficulties and obstructions encountered in constructing the intricate underground network of the city pipe system in the streets of San Francisco, was certainly, from his actual experience in this work, and knowledge of its cost, in a better position to estimate the cost of reconstructing or duplicating complainant's present pipe-distributing system than any other witness.

Most of this work is under the surface of the streets and pavements. Mr. Schussler not only knew what was under the ground, but he alone knew the difficulties and obstructions to be met in placing it, for as the greater part he had himself put it there—for it was placed under his direction as engineer.

Speaking of those difficulties, he says (pp. 1449 et seq.):

> "I shall now come to other obstructions and difficulties encountered in this city in laying and constructing a pipe system for water supply purposes. The greatest and most serious and most costly difficulties are encountered in the ground below the pavement, in the form of difficult ground and in the form of obstructions. As regards the character of the ground encountered, in some instances very hard rock is encountered, and as the blasting of the same is not permitted in this city, the cuts and trenches and joint-holes have to be broken out by picks, ham-

mers, gads, wedges and chisels, frequently costing us over $3.00 per cubic yard of rock so removed. The most favorable soil is a sandy clay that will stand up without requiring timbering after the ditch has been cut; a ditch which is more expensive than in this sandy clay is the one in clean, dry sand, which requires careful and close timbering so as to prevent it from caving in, particularly in case of basalt pavement overhead, and especially where the ditch is cut below the bituminous and concrete pavement. Regarding the obstructions encountered below the pavements in this city, there are portions of this city, especially in the business district, where the obstructions encountered below the pavements form such a net-work and maze of works and conduits of every description, which have the prior right and must not be interfered with under any circumstances; in other portions of the city these difficulties below the pavements exist also, but to a lesser degree than in the business district, while in the out-skirts of the city, where the houses are scarcer and further apart, a still smaller proportion of the difficulties alluded to exist below the pavements.

The obstructions below the pavement alluded to consist of: numerous gas mains, being largely the result of a number of former competing gas companies now mainly combined; the gas service pipes also leading from these mains into the houses compel us, in nearly every instance, to go below them with our main pipes, thus causing much extra cutting of trenches to a greater depth, and much extra cost of handling the pipe. The city's main sewers and street crossings, as well as the thousands of house sewers that we encounter, have to be passed, either over or under, by costly elbow and fitting work in the main pipe. The many house sewers encountered have to be avoided by going either over or under them or in case this is not possible, they have to be reconstructed by us at our expense. The next class of obstacles, which are very numerous, are the many electric light

conduits and the many large brick and concrete manholes connected with them, all of which have to be entirely avoided by going under those conduits and around the manholes. If we encounter them in the ground we cannot lay our pipes on top of them and we have to go underneath them and we have to go with elbows, bevel hubs and other fittings around the manholes. Thereafter comes another class of obstructions, to-wit: the various large telephone conduits, with their manholes. These conduits being either of terra cotta, fibre pipe encased in concrete, and wooden boxes either with or without a concrete casing surrounding them—all of these structures have to be entirely avoided in the laying of our pipe system.

The many power plants in the business portion of the city have numerous conduits under their pavements, which also have to be avoided by passing around them and under them. The cable railroads, as well as the electric railroads, furnish a great deal of costly obstruction where we have to cross the streets, as we have to go with many bends and elbows underneath these structures, without interfering with them or their running; and at the same time, in crossing the street, we have to go with our pipe, with various curved elbows over the main sewer, while passing underneath the cable roads and electric roads. It is particularly when crossing cable roads that great difficulties are encountered, because the concrete substructure of the cable roads generally reaches lower than the level of the top of the brick main sewer, particularly in the lower business portions of the city, so that a great deal of costly elbow work and delay in handling the fittings through this crooked passage is occasioned, particularly as in those very places extraordinary precaution has to be taken to make absolutely tight joints and to strap the elbows and fitting together with iron bolts and straps. In every street where there are electric or cable cars being operated, a great loss of time of our work-

men is occasioned by the interruption of our work by the passing cars, as the pipes have to be deposited first on that side of the street which is opposite to the side where they are to be laid, and therefore each piece of pipe has to be rolled over across the railroad track between the passing of the various cars. In the business portion of the city the delay caused by passing teams is considerable; also, while the men are lowering the pipe into the ditch, and while handling it in the ditch by ropes passed underneath the same, while the men are standing on the side of the ditch, one-half of the men stand near the car tracks and the other half of the men on the opposite side and a great deal of occasional delay is caused by these men having to get out of the way of the passing cars. Based upon our many years' experience in connection with overcoming the many great difficulties encountered under the pavements of this city while laying pipes thereunder, the following map has been constructed; it divides the city into three districts—district A, district B and district C. I herewith furnish the map as an exhibit."

Mr. Schussler then described the three districts, A, B and C, outlined on the above exhibit, giving their respective boundaries and specifically detailing the comparative degree of difficulties and obstructions encountered in them; and he continues (p. 1456):

"This intricate maze of obstructions underneath pavements of streets which, in many cases, almost fills the narrow strip between the street car tracks and the curbstone, has, during the past decade, so enormously increased the difficulties and consequently the expense of laying new pipes in the streets of San Francisco, that it is growing annually more costly to lay a system of distributing pipes, with all of its necessary fittings and connections, and to replace the pavement in first-class condition."

Of his own personal knowledge of all this work he says (and he is not and cannot be contradicted):

> "I am now the only living witness that has seen the construction of practically all of the work of the Spring Valley Water Company constructed since the end of the year 1864, and have designed most of these works and watched their construction in detail." (Test. p. 708.)

He was therefore fully justified in the statement made by him in answer to the next question put to him:

> "Nobody who has not been present during the construction of all of these works in all their details can judge these works simply from their outside present appearance, nor can he judge with what extreme care the materials used in the construction have been selected, prepared and placed in the work. As the only watchword through all these 40 years has been 'good work,' the question of expense was a secondary consideration, although proper economy was always practiced, with all of the other work performed, as we saw to it that each man and team did a full day's work." (p. 709.)

All of Mr. Schussler's cost estimates regarding the city distributing pipe system are based upon his long experience with and intimate knowledge of both the cost of materials and of labor performed, and the difficulties and cost of performance of this class of work when done in the San Francisco streets under the conditions here, as previously detailed.

A recapitulation of his more fully detailed estimates of what it would cost to reproduce, in 1903-04, the present city distributing pipe system, including 10 per cent for incidental, contingent, engineering and superintending expenses—and also including $80,500 for special structures, such as: sewer tunnel and pipe tunnel

at Lake Honda Reservoir; two Bernal Heights tunnels; Islais Creek trestle; tank at Carville; was given by him as follows (Test. p. 1501):

"Recapitulation of City Distributing Pipe System.

Cast-iron pipe, 2,179,260 feet, or 412.74 miles	$5,108,300
Wrought-iron pipe, 61,050 feet, or 11.56 miles	591,900
Special structures	80,500
Total	$5,780,700
Add 5 per cent for interest during construction	289,035
We have a total of	$6,069,735

or, in round figures, $6,069,000."

Outside of the engineering or expert witnesses who testified for defendants, four witnesses, Mr. Fifield, Mr. Carey, Mr. Higgins and Mr. Emery, either saw portions of these works constructed, or participated in the original construction of some of the works.

The testimony of Mr. Fifield, Mr. Carey and Mr. Higgins has heretofore been fully analyzed in this brief, with the result that where Mr. Fifield's testimony regarding one item of the hauling of sand was positive, reliable and useful, the testimony of Mr. Carey and Mr. Higgins was shown to be vague, unreliable and of no aid in determining either the original cost or the cost of reproduction under present conditions.

The testimony of Mr. Emery has been sufficiently referred to in connection with the Pilarcitos main dam.

All of the other witnesses of defendant and of complainant (with the exception of Mr. Schussler), who attempt in their testimony to give detailed estimates of cost of original construction or present reconstruc-

tion, labored under the one disadvantage that they were neither present at the original construction of the works, nor were they familiar with all the circumstances, conditions and difficulties met by complainant, nor with the high-class quality of materials and workmanship employed at that time.

Neither Mr. Fitzgerald nor Mr. Dockweiler attempts to give any detailed estimate of cost of either original construction or of present reconstruction of the separate structures.

Mr. Fitzgerald attempts to show the cost or value of complainant's constructed works—not by detailed structures, but only in systems or groups. He admits that his gross estimates of the cost of these groups or systems of works are based upon his computations and not upon knowledge of the original cost of the properties, which were visited by him many years after the periods of their original construction.

Mr. Dockweiler's testimony shows that he has not constructed any water works of the character or magnitude of those of complainant. He, therefore, has not had the experience which is absolutely essential in order to form some kind of judgment of what similar works might have cost to construct, or what they would now cost to reproduce. Furthermore, he was not familiar with the conditions, circumstances and difficulties met and overcome by complainant, nor present at and familiar with the construction of the separate structures which constitute the various systems. His valuation could be but slightly assisted by the two general trips which he made over complainant's properties, where he could only see the external appearance of the constructed works.

The three other expert witnesses who placed estimates on the cost or value of the separate structures

of complainant's structural works, Mr. Adams and Mr. Schuyler, for complainant, and Mr. Grunsky, for defendant, all labored under the great disadvantage of not having been present at and familiar with the conditions, circumstances and difficulties met in the original construction of the large list of separate structures embraced in complainant's properties. During the general round trips over complainant's properties made by any of these three witnesses for the purpose of and prior to their testifying in this suit, they could only look at the outside appearance, as far as visible, of these structures, which had been constructed years or decades prior to such visit. Except where such external view of a structure disclosed the high-class quality of materials used and workmanship employed, they could not fully know, appreciate and judge all of the elements and factors that entered into the original cost or that would enter into the cost of present reconstruction.

XXI.

Works Out of Use.

The Deductions Claimed by Defendants' Counsel on This Account Are Excessive.

Defendants' counsel in their brief (pp. 104 et seq.) give lists of properties and works which they claim should be deducted as "not in use."

Under this head the table printed on pages 105-6 of their brief contains thirty-six items, aggregating in value, according to their estimates, $1,785,746.35. Of the constructed works mentioned in this list of 36 items, neither their original cost nor their present value has been included in Mr. Schussler's final estimate of the

present value of complainant's combined properties and rights, as will be seen from his testimony.

In their estimates of the total cost of original construction, however, they deduct the whole of their estimated original cost from the total cost of original construction. This is not proper or fair, because, admitting that the constructed works enumerated in the list are now out of use, the testimony shows that large portions of the pipe lines, which formed parts of the works mentioned have been taken up and have either been incorporated in and become parts of other structures now in use, or form part of complainant's stock on hand. In this category are the following three items taken from defendants' list on pp. 105 and 106 of their brief:

Page of Brief	No. of references	Properties	Number of years out of use	Admitted out of use (by Mr. Reynolds)
105	24	San Andreas pipe line (part)	7	$ 79,000
106	31	Lake Merced old pumps	24	156,318
106	32	Crystal Springs old pumping station	21	79,804

Item 24.

Item 24 of the above list of defendants purports to represent Mr. Reynolds' estimate of that portion of the original 30-inch San Andre pipe line, the disposition of which was accounted for on page 2189 of Mr. Schussler's testimony, and also detailed in a preceding portion of this brief. The original total length of the San Andres 30-inch pipe line was about 65,300 feet. About 26,000 feet of this was displaced by 30,230 feet of the new 44-inch San Andres pipe line, laid over another route. About 20,000 feet of the 26,000 feet thus displaced has been accounted for by Mr. Schussler in the

present works and stock on hand of complainant. Counsel for defendant, therefore, are in error in throwing out, as they do in their table, the entire $79,000, which they evidently estimate to be the value of the entire 26,000 feet of original 30-inch pipe displaced by the new 44-inch pipe. As above shown, there are now about 20,000 out of the 26,000 feet in use or on hand, and the estimated $79,000 should therefore be very materially reduced.

Item 31.

Item 31 represents, according to defendants' brief, Mr. Reynolds' figures on the original cost of the "Lake Merced old pump." As shown by Mr. Schussler's testimony, the original construction of this old Lake Merced pumping plant included the laying of about 17,000 feet of 22-inch force-pipe, so as to connect it with the San Andres 30-inch pipe line. Regarding the length and subsequent disposition of this 22-inch force-pipe line, Mr. Schussler says (p. 1742):

"At that point" (on the 30-inch San Andres line) "we connected the 22-inch force-pipe from the Lake Merced pump."

X. Q. 845. "Is that the same pipe that leads up here today?"

A. "No sir, we took that up and used it in other places."

Q. 846. "How long was that?"

A. "I think it was somewhat over 17,000 feet long."

* * *

Q. 849. "In what year did you take that up?"

A. "That I do not remember. We left it in the ground until such time as we needed 1,000 or 2,000 or 6,000 feet; we simply took the pipe and cut it and removed it. It was laid with lead joints, so it was easily taken up."

Counsel for defendants deduct from the total estimated original cost the entire estimated expenditure for the Lake Merced old pumps, of $156,318. Allowance should be made for 17,000 feet embraced therein of 22-inch force pipe, nearly all of which has been relaid and accounted for in other parts of complainant's works.

Item 32.

Item 32 in defendants' list of works not in use represents, according to defendants' brief:

Page 106: "32.	Crystal Springs old pumping station (admitted by Reynolds)	$ 79,804.00"
Page 109: "32.	Crystal Springs old pumping station, Mr. Dockweiler's items allowed in part by Reynolds (balances not allowed in each case)	26,000.00"
	Total for Crystal Springs old pumping station.....	$105,804.00

Regarding the disposition of machinery, force-pipe and portions of the flume connecting this station with the Pilarcitos conduit, Mr. Schussler's testimony shows that the pumping plant was moved to Ocean View and is now the Ocean View pumping station (Test. p. 1740), which is now in use. As to its use Mr. Schussler says (Test. p. 1327):

"The Ocean View pump draws its water from the San Andreas pipe, from which a branch pipe, 18 inches in diameter, discharges a portion of the water

from the San Andreas pipe, whenever it is desired, into a large tank at the Ocean View pumping station, with which tank the suction pipe of the Ocean View pump is connected. The Ocean View pumping station is called a relief pump in case of any disability or break-down on the lower portion of the Lake Merced force-pipe, or in case any accident should happen to any part of the pump."

Regarding the disposition of the 18-inch force-pipe of this original Crystal Springs pumping station, Mr. Schussler says (p. 1739):

"The pipe has been taken up and used wherever we had use for an 18-inch pipe."

The value of this 18-inch pipe, therefore, should not be eliminated from the estimated cost of construction of the works now in use.

Regarding the disposition of the flume, which connected this 18-inch force-pipe with the Pilarcitos conduit, Mr. Schussler says (p. 1839):

"We used a good deal of the lumber over again for other flumes and we used the pipe" (18-inch) "for other purposes."

These quotations from the testimony show that counsel for defendants are in error when they attempt to throw out of their estimates the entire expenditure of $105,804.00.

Other Unwarranted Deductions for Properties Not in Use.

Under the head of "Mr. Dockweiler's items allowed in part by Mr. Reynolds (balances not allowed in each case)," counsel for defendants, on page 109 of their brief, among other items give the following list of works

now in use, which it attempts to eliminate from the value of complainant's present works:

"42.	Crystal Springs upper dam, proportional cost of dam not useful	$180,827.63
43.	Ocean View pumps	25,349.24
44.	Upper Pilarcitos dam	31,376.40
45.	Calaveras dam; explorations and surveys	44,446.46
46.	San Antonio improvements	4,305.47"

Item 42.

Regarding this item counsel say in substance:

"No. 42, Crystal Springs upper dam. The cost of this dam, as given at $230,827.63 by Mr. Dockweiler (p. 646), is set out by Mr. Wenzelburger at page 227 of Exhibit No. 101. Mr. Dockweiler stated that the dam serves as a roadway, and deducting $50,000.00 as the cost of a steel viaduct, obtained $180,827.63 as the proportional cost of the dam not in use (p. 646). In the section of this brief on structural works, extract from the minutes of complainant is given (book "D," June 19th, 1890, page 345), particularly emphasizing the fact that this dam is to be used only as a roadway. We, therefore, reinstate Mr. Dockweiler's deduction of $180,827.63."

On page 318 of their brief counsel quotes from the minute book of complainant's Board of Directors a resolution declaring that the embankment to be built on the top of this dam is for the purpose of a roadway and not for a reservoir bank.

In this resolution, however, the following important clause is inserted:

"any good material that is found in the neighborhood and that in the opinion of the S. V. W. W. engineer is fit to go into the embankment, is to be used, and

to be filled in and applied in such a manner as engineer directs."

A reading of the whole resolution shows the clause last quoted, relating to the quality of material to be used and the manner in which it was to be put into this dam becomes of importance in view of Mr. Schussler's testimony as to the manner of construction and the purposes for which the original dam and the additional height to which it has been raised are actually used.

On these subjects, Mr. Schussler, in his testimony, says (p. 224):

"At 47 feet depth" (of the lower or main reservoir) "both reservoirs, namely, the upper and the lower reservoirs, are joined; that is, it takes 47 feet depth of water in the lower reservoir to reach the level of the bottom or outflow of the upper reservoir. From the 47 foot level we continue the reservoir capacity jointly, although during the rainy season, when the water is muddy in the upper lake and much clearer in the lower lake, we keep the gates shut in the outlet tunnel of the upper dam so as to allow the water in the upper reservoir several months time to settle. If we did not do that the very riley water accumulated during the storms in the upper reservoir would at once mix with the much clearer water in the lower reservoir and also make it riley and slightly objectionable to the people. Therefore, by this system of closing the gates in the upper dam outlet we succeed in keeping a constant supply of very clear water to flow into the city from the lower reservoir alone. We do not open the outlet from the upper to the lower until later in the summer, when the settlement of the sediment in the upper lake has completed itself and clarified itself."

Again on pages 2195-9 he says:

X. Q. 2849. "In what sense is the upper Crystal Springs dam in use now?"

A. "I have detailed the use of the upper Crystal Springs dam in my direct examination."

X. Q. 2850. "Just shortly, what is it?"

A. "In the first place it serves as a roadway for the people coming from Spanishtown and going to San Mateo and so forth. The county road formerly ran along the bottom of the Crystal Springs Valley, and when we built these dams the road had to be replaced by another road that the county supervisors requested us to build and give them a deed for, which we did. That road leads from San Mateo Canyon, starting from a point below the main Crystal Springs dam, and leads past the southerly end of the main Crystal Springs dam to and over the upper Crystal Springs dam, and from there to Spanishtown. That is one of the uses. The main use is that it divides the upper Crystal Springs reservoir from the lower. It served originally, as I have stated, as the storage reservoir in the Crystal Springs Valley, prior to the construction of the main lower reservoir. At that time when we had only the upper Crystal Springs reservoir and the 44-inch pipe leading directly from there into San Francisco we had, every winter, a great deal of trouble with muddy water because, it appears, that the wash from the large watershed of 14 or 15 square miles, shedding directly into the upper Crystal Springs reservoir, produces a great deal more silt and mud than the other portion of the lower lake. That water is always much clearer. Every winter there was constant complaint about the muddy character of the water. That was not remedied until we cut off the pipe from the upper dam to the lower and supplied the city from the lower reservoir, so that the muddy water from the upper lake cannot directly flow into San Francisco. We keep the gates in the upper dam closed until far into the summer, so that

all the muddy and yellowish color of the water settles and disappears and the water becomes quite clear. When the water is thoroughly settled, although the lower lake may be a number of feet lower at that time than the upper lake, we open the gates slowly and draw the water from the upper into the lower."

* * *

(p. 2198) Q. 2860. "How much would a bridge cost across there?"

A. "I do not know. It would have to be a tall bridge on piers; at present it would be about 80 feet high, but eventually nearly 100 feet high."

X. Q. 2861. "Would it cost $345,000?"

A. "I do not think it would cost quite that much."

X. Q. 2862. "Would it cost half that?"

A. "I do not know. We have not estimated on that. It would certainly be a great nuisance to watch that constantly, with people racing over it with their heavy teams. The main thing we need is the separation of the two waters; that is of very great importance. If eventually, first, the coast streams are connected with the Crystal Springs reservoirs I would not think of connecting them with the lower Crystal Springs reservoir, because that is the portion of the reservoir from which we draw the clarified and settled water. The plans are made to connect the coast streams either by way of a direct line along the coast, or, in all probability, by way of Searsville or Portola, by a big tunnel and flume line carrying the very muddy waters of those coast streams. During the storms and during the freshets we could, under no circumstances, send that water directly to San Francisco; the people would rebel against it, and, I believe, the Board of Health would object to it. In this manner we would have to construct a division wall of some kind, either of earth or of other material, across that valley. In view of the proposition of carrying those large and very productive watersheds of the coast streams, with their very muddy storm waters of the winter, into the Crystal Springs reser-

voir, it would be an absolute necessity to build that dam—that division dam."

X. Q. 2863. "Will that upper Crystal Springs reservoir hold any more water than you put into it now?"

A. "Oh, yes, we could raise it higher."

The above quotations from Mr. Schussler's testimony, on the subject of the upper Crystal Springs dam, show that this dam, after originally performing its function as a dam for storage purposes, has, since the construction of the main Crystal Springs dam, proved to be an absolute necessity for the purpose of clarifying the turbid waters of the upper reservoir of sedimentation and settling before allowing them to flow into the lower reservoir.

While this dam performs this most important duty, the top of the embankment, at the same time, serves as a roadway. A steel viaduct, as suggested by Mr. Dockweiler and by defendants' counsel, even if it could be constructed for $50,000 (at which he places its cost without giving any details), would only serve as a roadway, and not fill the important and essential mission of acting as a separation wall between the frequently turbid waters of the upper and the clear waters of the lower portions of this reservoir.

The contention of defendants' counsel, therefore, that the upper Crystal Springs dam is not in use nor useful, except as a roadway, is untenable.

The next item of structural works which defendants wish to eliminate as not in use, is the

Item 43; *Ocean View Pumps.*

Counsel for defendants quote what they claim to be the original cost, at $25,349.24 (p. 109). This figure, in all probability, does not include any allowance for in-

cidental, engineering, etc., expenses; and it is also questionable whether all direct cost charges properly belonging to this structure are included therein.

Mr. Schussler gives in detail his estimate of cost of reconstruction in 1903-4 of this station, which, exclusive of 10 per cent for incidentals, etc., amounts to $28,391 (Test. p. 1328). His figures exceed the figures for purported original cost of construction as estimated by counsel by only 12 per cent.

As heretofore shown by Mr. Schussler's testimony, in connection with defendants' Item 32, "Crystal Springs old pumping station," the Ocean View pumping station is in use and ready for use, and its value should therefore not be deducted.

Item 44; *Upper Pilarcitos Dam.*

The next item in counsel's list of works, claimed to be not in use, is the original or upper Pilarcitos dam, for the original cost of which defendants, in their table (Brief p. 109), deduct $31,376.40.

Mr. Schussler estimates the cost of constructing this dam in 1903-4, and including ten per cent for incidental, etc., expenses, at $39,000 (Test. p. 762). By deducting this ten per cent, or $3,545, it would make the cost of present reproduction, without the ten per cent for incidentals, etc., $35,455, which, compared with the purported original cost of probably only direct charges, of $31,376.40, of over forty years ago, when labor was much cheaper than now, shows that Mr. Schussler's estimate for 1903-4 is very conservative.

Regarding its use or usefulness, Mr. Schussler says (Test. p. 761):

> "Finally, the upper Pilarcitos dam, which was originally used, as I have heretofore described, as forming a reservoir for the old works, a flume and

tunnel line leading from there into San Francisco, and, as I stated before, the difficulty was, it being small, that when a storm came with muddy water, all the water got very muddy, as all the debris went into that upper lake. When we built the lower dam we maintained the upper dam in its place, and it is now very useful in this, that it retains the muddy water back there, especially during the freshets, when the lower reservoir is low, in the beginning of the rainy season, and thus we manage to have clear water in the lower dam practically all through the year."

Items 45 *and* 46; *Calaveras Dam and San Antonio.*

The next two items, 45 and 46 in defendants' list of works, which it claims not to be in use, and should therefore be eliminated (Brief p. 109), are:

"45. Calaveras dam; explorations and surveys $44,446.46
46. San Antonio improvements.... 4,305.47"

In regard to this work and its purpose and importance, Mr. Schussler says (pp. 1120-1121):

"In investigating this foundation of the Calaveras dam in the Calaveras Valley, as also the foundation in the San Antonio dam in the San Antonio Valley, a certain amount of work was done. This was done for the purpose of ascertaining the character of the foundation that we would encounter in the construction of the two proposed reservoirs, one in the Calaveras Valley and one in the San Antonio Valley. The work done on the foundation of the Calaveras dam was done at the place where it is proposed to erect a large concrete dam. The work that we did there consists in sinking shafts and running numerous tunnels into the side hills, sinking shafts in the bottom of the valley down to the bedrock and into the bedrock to thoroughly examine its character and stabil-

ity and also to cross-connect these various shafts and tunnels with each other, to see whether the character of the rock we encountered in the shafts and drifts was continuous. The work done at the Calaveras proposed dam also included the opening of a stone quarry, which was got ready and prepared for immediate work the moment it was concluded to go ahead with the work. This stone quarry is some little distance up the Calaveras Creek, probably a mile and a half or two from the dam site, and when opened and when the works are put in operation for the construction of the dam at Calaveras a narrow-gauge railroad will be constructed which will be used to transport the rock down to the dam site.

"The work done on the foundation of the San Antonio dam, which is much nearer the Sunol filter-beds, consists in sinking of a number of shafts from 35 to 40 and 45 feet in depth for the purpose of prospecting its foundation. There was no work done in the opening of a quarry as we propose to use the cobble-stones of the Calaveras Creek, which are there in enormous quantities and which we propose to break up into small fragments as we intend to use them for the purpose of making our concrete."

Again, on pages 2420-21, he says:

X. Q. 3670: "Did Mr. Kellogg advise you to take out the $50,000 you spent on the Calaveras reservoir site for borings and tunnels?"

A. "He did not, because that is new construction."

X. Q. 3671: "Is that in use?"

A. "That is in use today as developing the foundation of that dam. Those things are necessary prior to the construction of a dam."

X. Q. 3672: "It is not any more necessary prior to the construction of a dam than the dam site, is it?"

A. "Yes sir."

X. Q. 3673: "In what way?"

A. "First you must have a dam site and then you may find by investigation, by prospecting and

sinking shafts and driving tunnels that your dam site is not worth much because the foundation is poor. Before we could definitely calculate and figure on the cost of construction of the Calaveras dam at the proper time it was absolutely necessary to make the proper investigations, which we did, and that is a part of the construction of the Calaveras dam."

In his cost estimates for this work Mr. Schussler's testimony enumerates the principal work done in connection with the above work at the Calaveras and San Antonio dam sites as follows (pp. 1121-2):

At the Calaveras dam site:

3,350 feet of tunnels; various shafts, of a total depth of 190 feet, having an average area of 6 by 8 feet; one shaft 42 feet deep, of an area of 6 by 12 feet; one shaft from 20 to 30 feet deep, having an area of 12 by 57 feet.

The shafts were well timbered and there was considerable pumping required.

At the San Antonio dam site there were a number of shafts sunk (from 35 to 45 feet in depth; see page 1121).

Mr. Schussler's cost estimate for all this work in 1903-4 is (p. 1122):

For Calaveras dam site	$43,400
For San Antonio dam site	4,300
Total	$47,700
"Adding 10 per cent for incidental and contingent expenses, engineering, superintending, etc.	$ 4,770
We have a total of	$52,470
or, in round figures	$52,400

The above quotations show that this preparatory work for the dams for the proposed Calaveras and San

Antonio Reservoirs, is an essential and necessary part of their construction, and the cost of this work, therefore, should not be thrown out, as proposed by defendants' counsel.

Counsel for defendants (brief, p. 110) seek to deduct $25,000 as their estimate of "Portion of concrete dam, Colma Gulch drainage system, Lake Merced." It is shown in complainant's testimony (pp. 1229-1231 and p. 2256) that, although this is not now in actual use, it is proposed to be used in the construction of the third or upper silt-storage dam, so that it is property which is immediately useful and ought not to be deducted.

XXII.

Mr. Schussler's Estimates Compared With Those of Other Witnesses.

The recapitulation of Mr. Schussler's estimates of cost of reconstruction in 1903-4 of complainant's constructed works comprising the systems enumerated on page 1516 of his testimony, as corrected at his request as shown in his subsequent testimony (pp. 2035-6, 2040, 2181-2) by the deductions of $20,000, from the Pilarcitos system, $33,000 from San Andres system and $16,000 from Crystal Springs system, (and including 10 per cent for incidental, contingent, engineering, superintending, etc., expenses, and 5 per cent for interest during construction) is as follows:

1.	Pilarcitos system	$ 1,148,000
2.	San Andres system	1,547,000
3.	Crystal Springs system	3,811,000
4.	Lock's Creek aqueduct	419,000
5.	Alameda Creek system	3,383,000
6.	Lake Merced drainage system	343,000
7.	Pumping plants	1,651,000
8.	City Reservoirs	947,000
9.	City pipe system	6,069,000
10.	Meters connected with the city pipe system	150,000
11.	Stock on hand in San Francisco County and San Mateo County yards	270,000
	Total	$19,737,000

Schussler's above total estimate of cost of reconstruction in 1903-4 includes $150,000 for meters and $270,000 for stock on hand, without which two important items the works of complainant cannot be successfully operated. These two items have not been included in the estimates made by some of the other witnesses. For purposes of comparison, therefore, these two items, aggregating $420,000, should be deducted from his total estimate of $19,737,000, leaving his total estimate for the purposes of comparison $19,317,000.

As heretofore stated, this sum includes 10 per cent for incidentals, etc., and 5 per cent for interest during construction.

With these items of engineering, etc., and interest deducted, the total of Mr. Schussler's estimate of cost of present reconstruction of items 1 to 9, both inclusive, of the above list of complainant's works, and therefore, without any allowance for incidentals, etc., nor

for interest during construction, amounts to $16,724,-675.

Counsel for defendants in their brief (Table 3, p. 198) compare Mr. Schussler's estimates with those of Mr. Adams, Mr. Schuyler and Mr. Grunsky. The three witnesses named, in arriving at their final respective totals, vary as to the percentage allowed by them for incidental, etc., expenses, and Messrs. Adams and Schuyler allow less than 5 per cent for interest during construction, while Mr. Grunsky entirely omits this item of interest from his estimate.

Owing to these variations between their respective methods and that adopted by Mr. Schussler, the only fair comparison to be made between Mr. Schussler's estimate, on the one hand, and the estimates of Messrs. Adams, Schuyler and Grunsky, on the other, would be by comparing the totals of the first nine items of Mr. Schussler's list, as given above, eliminating for the purposes of comparison the two items of meters and stock on hand.

In defendants' Table No. 3 a comparison is shown between Mr. Schussler's total, on the one hand, and an average of Mr. Adams' and Mr. Schuyler's totals, on the other hand, in which comparison defendant uses figures which are apt to mislead.

Mr. Schussler's total, as shown in defendants' Table No. 3, of $19,467,000, includes $150,000 for meters, and 10 per cent for incidentals, etc., and 5 per cent for interest during construction of all the items of work mentioned in the table.

Mr. Adams' total, in the same table, of $16,062,445, includes, ostensibly, 7 per cent for incidentals, and 5 per cent for interest during construction. But the method of figuring adopted by defendants' counsel

gives really only 12 per cent on Mr. Adams' original total estimate, instead of 7 per cent on his original total and thereafter 5 per cent additional on his original total, plus the 7 per cent for incidentals, etc.

Mr. Schuyler's total in the same table of $17,924,806 includes ostensibly 10 per cent for incidentals, etc., and 5 per cent for interest during construction. But the method of figuring adopted by defendants' counsel gives really only fifteen per cent on Mr. Schuyler's original total estimate, instead of 10 per cent on his original total and thereafter 5 per cent additional on his original total plus the 10 per cent for incidentals.

Counsel for defendants, in the same table, in making their comparison between Mr. Schussler's estimates and the average of the separate estimates, as there shown, of Messrs. Adams and Schuyler, take the average of the totals of Mr. Adams and Mr. Schuyler for each separate system or group (*exclusive of any percentage for incidentals, etc., and of interest during construction*) and deduct these from Mr. Schussler's totals for the respective systems or groups (which *include ten per cent for incidentals, etc., and five per cent for interest during construction*).

The result of this operation on the part of defendants' counsel is that they place in column 34 of their Table No. 3, under the head of "Excess of Mr. Schussler's estimates over average of Messrs. Adams and Schuyler," differences of estimates for the respective systems or groups which are erroneous and misleading. A large part of the difference, separately shown in column 34 of defendants' Table 3, is due to the fact that Mr. Schussler's several estimates contain the allowance of 10 per cent for incidentals and 5 per cent for interest, while the averages of Messrs. Adams' and Schuyler's estimates do not.

The following illustration of counsel's method will serve to show its unfairness as to the Alameda system, which forms the first item in their Table No. 3. In column 3 of this table they compare Mr. Schussler's estimate of the constructed works of the Alameda system, inclusive of 10 per cent for incidentals, etc., and 5 per cent for interest during construction, $3,382,000.00, with the average of the estimates of Messrs. Adams and Schuyler of the constructed works on the Alameda system, but exclusive of any allowance either for incidentals or for interest during construction, $2,580,-435.00 (column 32), showing in column 34 an apparent excess of Mr. Schussler's estimates over average of Messrs. Adams and Schuyler of $801,565.00.

Mr. Schussler's total estimate for the Alameda system, of $3,382,000.00, when reduced by 5 per cent for interest during construction included therein, becomes $3,220,952.00. This figure, when reduced by 10 per cent for incidental, etc., expenses, included therein, becomes $2,928,138.00.

It is this figure of $2,928,138.00 of Mr. Schussler's estimate of cost of reconstruction, in 1903-4, of the Alameda system, with which defendants' average of Messrs. Adams' and Schuyler's estimates for this system, of $2,580,435 (col. 32) should have been compared, which would have resulted in showing a difference of $347,793 only, instead of the apparent difference of $801,565.00 shown in defendants' column 34.

Defendants carry this method of comparison all the way through the entire column 34, for all of complainant's nine systems or groups enumerated in their Table No. 3, with the result that the total "Excess of Mr. Schussler's estimates over average of Messrs. Adams and Schuyler" is made to appear to be $4,352,872.00,

an apparent difference of 22.53 per cent of Mr. Schussler's total estimates of $19,317,00.00.

Mr. Schussler's total of $19,317,000, after deducting the 10 per cent for engineering, etc., and 5 per cent for interest, is $16,724,675.00. When this is compared with the total average of Adams and Schuyler of $14,964,-128 (column 32) the actual difference is only $1,760,-547.00, or 10.52 per cent of Mr. Schussler's total, instead of 22.53 per cent, as counsel for defendants make it.

After counsel for defendants have used their column 34, as we have seen, to show erroneously an apparent excess in Mr. Schussler's estimates of $4,352,872.00 over the average of those of Messrs. Schuyler and Adams, they modify this total by deducting therefrom the average of the allowances made by Messrs. Adams and Schuyler for incidental, etc., expenses, and interest during construction, aggregating $2,029,497. In making this deduction, however, they again err in that where Mr. Schussler's estimate includes 10 per cent for incidentals, etc., and 5 per cent additional for interest during construction, or an actual total addition of 15.5 per cent on his total of $16,724,675, they arrive at their figure of $2,029,497 by taking the average between Mr. Adams' 12 per cent allowance for incidentals and interest on his total of $14,341,469, amounting to $1,720,-976, and Mr. Schuyler's 15 per cent allowance for incidentals and interest on his total of $15,586,788, amounting to $2,338,018. By deducting the average of these two results, or $2,029,497.00, from their above original $4,352,872 they arrive at the sum of $2,323,375, which they finally claim to be the amount by which Mr. Schussler's estimate exceeds the average estimate of Messrs. Adams and Schuyler.

That this process of computation is incorrect and unfair has hereinbefore been proven, by showing that the actual difference between Mr. Schussler's total of $16,724,675.00 and the average of Messrs. Adams' and Schuyler's totals of $14,964,128.00 is $1,760,547.00, and not $2,323,375.00, as counsel attempt to show in their Table No. 3, an error of $562,828.00.

XXIII.

Rights of Way.

Under this head counsel for defendants, on page 501 et seq. of their brief, dispute Mr. Schussler's testimony as to the length and present value of the rights of way now owned by complainant.

On page 511 they give a figure of $78,932.50 as obtained by Mr. Wenzelburger from complainant's accounts. This figure is probably the sum of various items, where original cost figures were charged directly to and under the name of rights of way. Counsel do not show whether this figure includes, or, if not included, how much or what proportion of cost of other purchases were charged or are chargeable to a right of way account, where complainant bought tracts of land for the dual purpose of water rights and rights of way; or for the triple purpose of water rights, lands and rights of way; nor do they show whether Mr. Wenzelburger's figure of original cost includes the many cases of rights of way purchased by complainant, where such rights of way were acquired by being partly paid for in cash and partly by an agreement to furnish water to the grantor at rates below, and some of them far below, the rates prevailing in San Francisco.

Mr. Schussler, in his testimony on the subject of complainant's rights of way through private property, gives the length of the same, as measured from the various respective maps, at about fifty miles. This length includes all the rights of way now in use on complainant's main conduit lines, from headwaters to the respective San Francisco distributing reservoirs. In this length are also included lengths of conduits where property was purchased for the dual purpose of obtaining water rights and rights of way, as for instance in the Alameda Canyon and below the main intake at the Sunol dam (which forms the lowest point of the six hundred square miles of the Alameda system watershed) of the Sunol aqueduct. In Mr. Schussler's estimate for right of way the length of the conduit through this property, as well as its separate value as right of way, is included in his measurements of total length and in his estimate of present value.

Regarding the present value of complainant's right of way over private property, now in use, Mr. Schussler, on page 1512 of his testimony, says: "50 miles of right of way over private property, outside of San Francisco County" (corrected on page 2891, by adding the words "distributing system") "at $10,000 per mile, $500,000."

XXIV

Partial Ownership of Watershed Lands.

Under this head counsel for defendants on pages 515-519 of their brief lay stress on the fact that the complainant does not own all of the land which is or will be tributary to its present or proposed reservoir sites.

After speaking of the fact that there are still some pieces of land left in complainant's peninsular watersheds, which the latter does not own, or had not acquired at the time of this suit, they say that, according to Mr. Dockweiler's testimony, complainant owns, on the Alameda Creek system,

> "23,399.59 acres, or 6 per cent of the total watershed of 600 square miles, which equals 384,000 acres. My computation does not include the lands lying in the Arroyo Valley or any lands that may be owned or held by them through trustees."

The argument of counsel apparently is that the actual value of the property which complainant does own is or should be less because complainant does not own the whole of the watershed supplying its waters.

Complainant, however, does own or control by far the largest portion of the watershed of its three large peninsular storage reservoirs in San Mateo County; and also most of the watershed of Lake Merced. In the latter case, complainant's testimony has shown that Lake Merced receives its entire supply from springs in and around the margin of the lake, which water has been filtered through the large and deep beds of sand surrounding the lake.

Regarding the water obtained and to be obtained from the Alameda Creek system, defendants fail to mention that all the water obtained from this system is, and always will be, thoroughly filtered through complainant's large gravel filterbeds on the same, before the water now obtained, or hereafter to be obtained, from this source, is supplied to San Francisco.

It is shown by the testimony, too, that the water supplied to San Francisco from the San Mateo County peninsular reservoirs is of good and wholesome quality,

as proven by long continued use as well as by chemical and bacteriological investigations from time to time made; and that the water supplied from complainant's Alameda Creek system, owing partly to the ownership and control by complainant of the most essential and vital features of this system, and partly and mainly to its thorough system of filtration of all the water drawn and supplied therefrom is of exceptionally pure and wholesome quality.

The testimony shows that complainant owns the whole or 100 per cent of the most vital features of its peninsular system, namely, its reservoir sites, and the whole, or 100 per cent, of the all-important and essential Sunol gravel filterbeds, and practically the whole, or nearly 100 per cent, of its proposed three large reservoir sites on the Alameda Creek system.

CONCLUSION

As we have intimated in the main body of our brief and argument on behalf of complainant it would be impracticable to follow counsel for defendant, item by item, through every matter discussed by them. We believe that what we have said is sufficient to show that, so far as concerns the structural properties of complainant, Mr. Schussler's estimates of what it would cost to reproduce them at the time to which this suit refers, represents very closely the actual value, much more nearly certainly than the estimates of any of the witnesses who testified on behalf of the defendants. Mr. Schussler's estimates are shown in every case to be based on actual knowledge of the constituent parts of every structure, the quantities and qualities of the materials used, the labor involved in constructing them and the cost of the same. The testimony offered on the part of the defendants is for the

most part mere guess work entitled to little, if any, consideration.

It is sufficient, however, for the purpose of this case that even on the lowest estimate of value at which the court can possibly arrive from all the testimony in the case, the rate fixed by the ordinance does not allow complainant a fair and just compensation for its services or a fair return on the amount of its investment. This we think is convincingly shown by the whole testimony, and even by the figures presented in defendants' brief and argument, when those figures are analyzed as we have analyzed them in the main body of our brief to which this is an appendix.

We again respectfully submit that the complainant is entitled to the permanent injunction of this court, enjoining the defendant from enforcing the ordinances in question as prayed for in the Bill.

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